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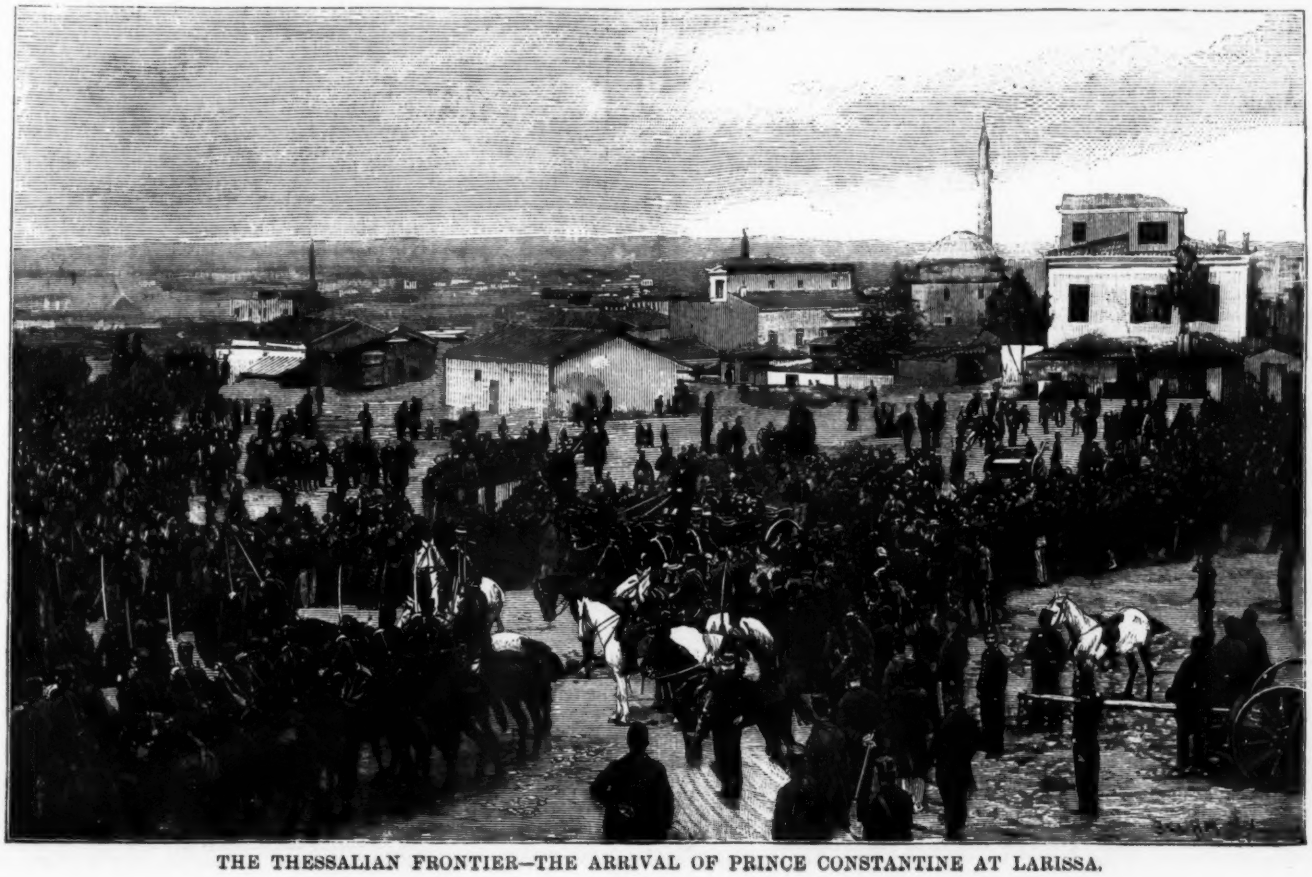
TURKISH SOLDIERS AT THE RAILWAY STATION AT SALONICA.



THE THESSALIAN FRONTIER—THE ARRIVAL OF PRINCE CONSTANTINE AT LARISSA.

THE WAR IN THESSALY.

We present a few engravings of interesting scenes connected with the Greco-Turkish war in Thessaly. The events of the last few weeks have been so faithfully described by the daily press that we will not take space to recapitulate them here. There is one side, however, upon which the war is of great interest. This is the use of artillery. Whatever opinion we may be disposed to entertain in regard to the importance of the question involved which brought the rival forces of Turkey and Greece into conflict, or whatever may be our respective sympathies, it cannot be denied that the result, deplorable as it now apparently is, serves a useful purpose to the lookers on, so that even what appears to be a useless war really has some value from the lessons it imparts. Actions such as those of the Yalu River, between Japan and China, or the recent capture of Milouna Pass, are invaluable, says The Engineer, "as exponents of relative importance attaching to the various fighting factors of the armies and navies in their modernized condition." Lessons which were taught by the battle of Yalu River have long outlived the interest which was taken in their action. A careful observer of the development of ideas in recent battleships and cruisers knows how many changes have been made as the result of experience gained in that great naval battle. Several points in the Greco-Turkish war have been very interesting to the student of military efforts. For the last ten years Turkey has paid great attention to field artillery. Herr Krupp, the great manufacturer of ordnance, had for many years an active business agent in Constantinople, and the result of his active efforts is that a large portion of the Turkish field artillery was armed with the latest pattern of the German ordnance maker's most powerful field guns, which were greatly superior in flatness of trajectory and in range to those of the Greek batteries.

A number of the smallest field howitzers were in the possession of the Turkish forces and they made awful havoc of the retiring Hellenic forces. The 5½ inch rifle

the Turks refusing to recognize it. In 1880 the powers again took a hand in the discussion and the suggestions of the congress of 1878 were reaffirmed, but Turkey was still recalcitrant. Turkey objected to be compelled to make so sweeping a cession of territory. It was evidently not the amount of land which was the difficulty in the minds of the Turks, but the new frontier would make it difficult to defend from the Turkish side, but easy to defend from the Greek side. It would, therefore, make it almost impossible for Turkey to invade Greece, but comparatively easy for Greece to invade Macedonia. To this the powers replied peremptorily that their decree was final and could not be reconsidered, so that whether Turkey was pleased or not the new frontier must be adopted and enforced. In the face of this Turkey was still defiant, and instead of applying the drastic measures which were imposed upon the powers, these great nations promptly repudiated their common order and agreed to a reopening of the matter and a reference of it to arbitration, and the German government was named as the arbitrator. The outcome was what might naturally be expected. Turkey received the boundary line which she wanted, with the single exception of Larissa, which was awarded to Greece, so that practically Turkey defied the whole of Europe and had her own way. The result of this diplomatic theft has been evident in the present war. The unjust boundary line has afforded the Turks every advantage for the invasion of Greece, and has made the defense of Greece impossible, even though she possessed an army far superior to that which she does. The victories at Milouna Pass and Larissa were really won years ago, when the Porte repudiated the Berlin treaty and when the powers signatory to the treaty of Berlin consented to that repudiation. It would seem to be only fair that Greece should demand from the powers some atonement of a palpable fraud in the enforcement of the boundary stipulations of the Berlin treaty. "It is not strange," says the New York Tribune, "that when the powers admonished Greece of the sanctity of

CHURCH IN THE BULGARIAN QUARTER OF SALONICA.

field howitzer has been found to be most satisfactory. The shell is of large size, weighing sixty pounds, and the damage done with such projectiles in earthworks is of course considerable. The terrible effect which the superior artillery arm of the Turkish forces apparently had upon the Greek batteries should be a sufficient warning to the military authorities of other countries to rehabilitate their artillery service.

"What in the name of common sense," says The Engineer, "would have been the use of 227,000 volunteers in the Milouna Pass with batteries of 8·4 centimeter field guns and 12 centimeter howitzers playing upon them from the surrounding peaks at a range of three miles?"

Another point which is interesting is that the current events in Greece have upset in a measure the strong opinions which have been expressed within the last few years upon the importance of what has been called "the command of the sea." During the Greco-Turkish war, the fleet of the Greeks has had undoubted supremacy, while the rejected hulks which pass for the Turkish navy remained in hiding in the Dardanelles. Notwithstanding the absolute sovereignty at sea possessed by the Greeks, they soon found that they were impotent to help themselves, owing to the smallness of their land forces. It should be remembered, however, that the expression "the command of the sea" has a slightly different meaning when applied to a nation like Great Britain with enormous colonial possessions.

Another interesting fact in connection with the Greco-Turkish war is that the northern boundaries of Greece were really obtained by a diplomatic theft. In reality the Greeks in invading Epirus were merely taking possession of the territory which by right belonged to them. The northern boundaries of Greece awarded by the powers in the treaty of Berlin of 1878, and the one imposed upon her in defiance of the treaty by Turkey and her partners, differ radically. In the central part of the peninsula the two lines coincide, but at the east the line awarded at Berlin runs considerably north of that actually adopted. The bulk of Epirus, including the city of Janina, should by right be a part of Greece. The affairs were nicely adjusted at Berlin, but in 1879 the conference between the representatives of Turkey and Greece failed to agree; the Greeks insisting upon the adoption of the Berlin Congress, and

treaties, Greece listened to them with some amount of skepticism."

Our illustrations, for which we are indebted to Le Monde Illustré and Illustrirte Zeitung, give a few characteristic views of the scenes on the frontier at Salonica and Larissa.

PRECIOUS STONES AS THEY HAVE INFLUENCED GEOGRAPHY.

In a recent lecture before the Franklin Institute, of Philadelphia, Mr. George F. Kunz, with Tiffany & Company, New York, spoke of the influence of precious stones, both the search for them and the trade in them, on geographical exploration and discovery, from which the following extracts are taken:

The first indications of the use of precious stones are found in Egypt and Assyria, in the latter at about 4,000 years before Christ. The earliest known gems are seals, of which we have the vertical form, believed to have been suggested by the joint of the bamboo, the conchoid, and the hemispherical, leading to the rude ring form. In the sixteenth century we meet faceted cut stones, notably the octahedral diamond of that period, cut on eight faces. Such high artistic ideals as were portrayed in the gems of the sixth century before Christ until the fourth century after have never been rivaled, although the ancient gems have rarely if ever the perfection and beauty of color demanded by the modern gem lover. Some of the finest gems in the crowns of Austria and Germany are sapphires and emeralds, pierced partly or entirely, having served as beads in Oriental necklaces.

One of the earliest lines of prehistoric trade was the amber commerce. The amber found in the tombs of southern Russia was identified as of Baltic origin, and it belongs to the same age as that found in the Tyrian tombs. Its strange occurrence, washed up by the waves of the Baltic, and its remarkable electric properties, combined to render it an object of mystery to the ancients, but it is now known that it is washed out of the tertiary coast deposits disturbed by the sea, and it is not only dredged for by hand and steam dredges, but actually mined from the same tertiary deposits many miles inland.

Many of the most precious stones, such as the ruby and sapphire, have from the earliest ages been brought from the East Indies. The Phenicians visited India 2,200 years before Christ, but later confined themselves more to Africa and Spain, enslaving the natives of the Spanish peninsula to work the mines of that country for silver and topaz—not real topaz, but smoky quartz which they decolorized and called Spanish topaz.

As empires rose and fell, the control of the jewel trade changed. As Phenician sway declined, Rome was destined to leadership, and Roman power was marked by the establishing of permanent facilities for land traffic, the great road starting from the Forum, reaching to the limits of the empire, and the outlines of the Roman empire can be traced by the increased gems alone found in its various dependencies.

To the fall of Rome and the rise of the Saracens, followed by the wars between Cross and Crescent, may be traced many of the finest jewels in Europe, brought from the East by the Crusaders. Then followed mercantile prosperity in Venice and Genoa in the sixteenth century. The Venetian fleet of three thousand merchant ships brought the products of the East and discharged them over Europe by way of the German cities of Oxburg and Nuremberg, whence arose the fame of the Nuremberg jewelers.

With the advent of the Turk the old routes to the far East were closed, and with the voyages of Columbus and the Spanish adventurers, the newly opened riches were claimed by Spain. Venice and Genoa declined, and then began the successful period of Spanish and Portuguese development. Portugal founded colonies and controlled the diamond trade of India, until the persecution of the Jews in Portugal drove them to Holland, thus transferring the diamond cutting industry to Amsterdam, which has since been the diamond cutting center of the world.

For centuries the only source of diamonds was India, the chief of which was the region of Golconda. The phrase, "diamonds of Golconda," refers not to the mines, but to the town where they were taken for sale. It is now little more than an abandoned fort, the Indian mines being largely worked out.

In 1734 diamonds were found in Brazil, and for 120 years diamonds were brought from that source. After various attempts to work these diamond mines by individuals, about a century ago the firm of Hope & Company, of Amsterdam, undertook the work and assumed the government debt of Brazil. Amsterdam thus continued to hold her position as the center of the diamond cutting industry, employing directly or indirectly from 30,000 to 40,000 people in that industry. Of late, Antwerp, Paris and London have been overtaking Amsterdam in this industry, Antwerp cutting one-quarter of the world's yield to-day. Within the last thirty years the Brazil mines have declined to the extent of $150,000 annually. The introduction of new machinery may render these mines again important, but they are now undersold by the great African diamond yield.

The African discoveries began in 1856, and they have had several distinct stages of development. Probably, had it not been for the diamonds, the African gold mines would not have risen to their present importance. The first diamonds were found on the Gong Gong River, in the neighborhood of the Orange River, and the method followed there is the same as that in Brazil, two or three men forming a company and working on their own account. These mines, known as the "river diggings," are now of limited importance.

The Kimberley mines are four great mines covering about 50 or 60 acres. The Harvey shaft at Kimberley is now about 1,200 feet deep. The mines are nothing but chimneys or craters in which the peridotite may come up, completely churning the black shale through it. The shale contains 35 per cent. of carbon, from which it is believed the diamonds have resulted.

The history of the Kimberley development is simply marvelous. A city of 55,000 inhabitants has sprung up from a desert. At first the mines were worked in separate small claims, there being as many owners as there were claims. Under the management of Cecil Rhodes, the De Beers Company was formed, with an authorized capital of $90,000,000,000. The stock is now held at $90,000,000. Last year they paid dividends of 40 per cent., besides undertaking the Matabele war and the expenses of the Jamison raid and the fines of Cecil Rhodes in connection therewith. Mr. Rhodes went to the colonies as a lad, without position or influence, but rapidly developed both. When he prospered, every one prospered, and had the Jamison raid succeeded, South Africa would have developed as never before.

The consolidated company limits the output of diamonds, so as not to lower the price, and thus far all the diamonds mined have been taken by the world, being carried by about 8,000 jewelers, who carry about one-third of the entire world's supply. The output of the African mines is sold until next June, at which time two syndicates will negotiate for the output for eighteen months to come. The chances are that for eight to ten years to come the output of the Kimberley mines will be limited, and syndicates will be ready to take every diamond mined. At the present time probably Mr. Cecil Rhodes knows just how many diamonds will be mined at Kimberley for the next ten years. The output last year was more than $20,000,000 and about 10,000 people were employed in working the mines and 30,000 people in cutting and selling the gems.

In order to guard the mining company from loss by theft, the natives, whether convicts or free natives, are hired for periods of from three to six months, and during their time of service are not permitted any contact with the outside world, being kept entirely within the inclosure known as the "compound," which is supplied with swimming baths, theaters, and other amusements.

Next to diamonds in value come sapphires and rubies, being respectively the blue and red varieties of the mineral corundum. True rubies come chiefly from Burma, Ceylon and Siam, and the gem producing districts are now chiefly owned or controlled by Great Britain. The much prized pigeon's blood rubies of Burma are almost impossible to obtain, those which get into the European collections being generally old gems. In Burma the gem producing district lies in the interior and the gems are found in a layer of soft yellow sand at a depth of a few inches. The method of procuring the stones is just as primitive as in Siam. Pits are dug and the natives carry the earth out in

baskets. In Ceylon, the rubies are found at the foot of Adams Peak. The hopes entertained as to both Burma and Ceylon have been disappointed, nor does there appear to be chance of future success unless by means of machine working. One well acquainted with these matters says: "What we want is an honest machine; one that will not only give us all the gemniferous substance, but guard it from the thievery of the pickers until raised to the surface of the earth and placed under European supervision."

Next in point of value to the ruby ranks the emerald. These for a long time were supposed to be found only in the Ural Mountains. Then came the discovery of the new world and the finding of these gems in the possession of the natives of the United States of Colombia, and the greatest yield is from the American continent to-day. The Ural Mountains have for thirty years been unworked, owing to the working privilege required by the Russian government. At Muso the emeralds were mined above and thrown into a waterfall which carried them down, the soft limestone rock being worn away in the descent and the gems collected in sluices below.

Garnets also were one of the early articles of commerce in the East. The center of garnet cutting has been in Bohemia. Russian excavations in the Caucasus have brought to light very beautiful garnets, among which are garnet slabs or plates set in gold, as well as beads, which may have been brought from India, as they are the Almandine, and not the Bohemian character of garnet.

In Bohemia the rock is an altered peroditite, and the garnet is also met on bed rock in what is evidently a glacial deposit. The earth is raised to the surface, washed, and the garnets sorted by girl labor. A diamond was found there in 1870, and it appeared for a time as if there might be a diamond field, such as we have in South Africa.

The turquoise furnished a marked example of geographical transportation of gems. For many years it was found in Turkey and sold at Teheran and Cairo. On the American continent we have turquoise in New Mexico. It was the cave-in of a turquoise mine in 1855 which led to the uprising of the natives and the expulsion of the Spaniards. Some of the most remarkable objects of archæological interest are the famous inlays found in New Mexico, the turquoise used evidently being of Mexican origin. One showing a skull is inlaid with turquoise and obsidian, the eyes being of iron pyrites. The American mines yield ten times as much as Persia in its palmiest days, and Peru and Bolivia may yet rival Mexico.

The opal may have been known to the ancients as far back as Roman times, for Pliny describes it with great enthusiasm. Until a century ago it was worn and known as the iris. The principal source of the opal has been in Hungary for three centuries. For a long time the opal was under a cloud, owing probably to Scott's "Anne of Geierstein," but the beauty and recent profusion of the gem has dissipated the superstition. It is largely a gem of the new world, some of the finest coming from Mexico and Honduras.

The rock crystal, sometimes called crystal, was known among the ancients as congealed ice, and is rarely found in pieces of sufficient size and clearness to make it of value in the arts. In Japan pure rock crystal is worked into art objects, notably the crystal balls. Recently these have been cut from quartz found in Brazil and Madagascar, and even in the United States, but little of the American material is fine enough for the large balls. The many centuries in which Japan was closed to the world led to an accumulation of crystal balls. Forty years of tourist buying have drained the country, so that perfect balls of four inches in diameter are rarely obtainable, and a six inch ball sells for \$10,000. The famous crystal ball given by Mr. Ames to the Boston Museum of Fine Arts is seven and one-eighth inches in diameter, for which he paid \$22,000.

In Japan the method pursued is to chip out a crystal ball and then run it in a small semicircular gutter, grinding it with sand or emery, and finally polishing it with rouge and chamois, and even, it is said, with the hand. The European method is to take a grindstone six or eight feet in diameter, cut a semicircular groove in it and hold the crystal in a socket against the running grindstone, thus shaping it in a week or ten days, which would otherwise require months.

Nearly twenty centuries ago Pliny described graphically how crystals were hunted for at that time, and his description serves for the method followed to-day. Men are let down over the side of cliffs to look for cavities, and, when found, the men go in and take out the crystals and are then hoisted up by ropes. In one grotto in the Swiss Alps twenty tons were found.

At Oberstein about 30,000 people are engaged in the agate cutting industry. The methods now used are the same as those of a century ago. Large polishing wheels are used, and the men engaged in the work must lie flat on their chests; they rarely live to be over forty years of age. If it were not for the coloring methods known to the agate cutters at Oberstein, their trade probably would not be so great as it is. The gray agate is the original color of the chalcedony. It is porous, and the heated waters run in and around until the agate is filled up; occasionally there are layers of white entirely impervious to coloring matter. By giving to a gray agate some coloring matter an agate or onyx of two or three colors may be obtained. The black is the result of staining the gray agate by first boiling it in sugar and water or blood and water or any other carbonaceous substance and then carbonizing it by dipping it in sulphuric acid. The entire world is supplied with agates from this source.

It was the sending of two Italians to the Ural Mountains that led to the establishment of the famous laboratory work there and ultimately to the establishment of a school for stone cutting carried on by the government. The boys are taught designing, modeling and cutting. The sending of these two men led to the development of the gem industries of the Ural Mountains to such an extent that to-day 1,000 people at least obtain a livelihood in the search for and cutting of the jaspers and other gems of the Url districts.

In former times diamond merchants could only travel under the protection of a caravan or with an armed guard. Now jewels are sent with far greater safety by means of the international postal service. Nearly all the rough diamonds taken from the South African mines are sent to London by mail.

A somewhat similar contrast may be noted in regard to keeping precious stones. Formerly the owners had to depend upon concealment or armed forces for the security of their gems, while to-day, by means of the safe deposit box, the private owner, for a nominal sum, finds complete protection from risk.

Since 1868 the United States has imported \$200,000,000 worth of cut diamonds with a duty of 10 per cent. The rough stones could not have cost more than one-half, and had the cutting been done in this country 5,000 men could have been employed at a yearly salary of \$1,000. It may be noted that the United States is the ultimate home of from one-third to one-half the world's product of gems.

THE FAT MEN'S CLUB, OF PARIS.

THE other day I attended the first meeting of the "Cent Kilos," a society comprising only such members as weigh at least one hundred kilos (220 pounds).

It was a question of discussing the constitution of the association and of establishing the bases thereof, which are necessarily solid!

Allowed the honor of taking part in the meeting, I was present and had a talk with Mr. Clement, the genial secretary, while the members were arriving.

In the first place came the president, Mr. Feche, a tavern keeper (352 pounds), a man with a good, open and frank face, who distributed to the right and left solid home thrusts at his colleagues, by whom they were quickly returned in kind.

An idea may be obtained from the accompanying engraving of the real and splendid ponderation of this notable boniface. In him there is no deformity, no repugnant adiposity, but the superb development of a human body that seeks to expand. Admire the happy air and the bright and mischievous eye of this man of weight while he is triumphantly making the beam of the sportive scales in which we have placed him incline toward his side. In the other pan, five boys of from twelve to sixteen years are vainly endeavoring to form a counterpoise. These are lads from the neighboring stables, who are appalled during the operation at the tremendous supercharge of this pantagruelic jockey.

But let us return to the meeting.

The president covers with his protection and presents with pride to the assemblage young Flomont, the biggest conscript of France, who places his 334 pounds upon a seat with great trouble. He looks a little confused amid the noisy peals of laughter of those present, and bestows upon them the placid look of a ruminant that makes one dream of broad meadows.

Then enters, majestically, Mr. Finck, a brewer (341 pounds), with a huge abdomen under a blue blouse—a rubicund and paunch-bellied type, such as we see in the smoke-covered paintings of old German taverns.

The brewer proceeds to take a seat alongside of Mr. Mathieu, the treasurer, a man of the world with a glossy high hat.

The meeting of the Cent Kilos was interesting, were it only for the fusion of the classes, the equality before the belly and the fraternity of weight. Every one gradually found a place for himself either poor or good, and the meeting opened.

The president endeavored to establish silence by means of a bell that hung on the wall, but the cord broke under his too vigorous pull. A few chairs groaned mournfully, every one was happy, and the secretary undertook to read the constitution.

Article I tells us that there has been organized at Paris a society called the Cent Kilos, the object of which is to establish a center of amical relations between the members, to make excursions, and to banquet, etc.

"Exactly so," cries some one. "It is a question of amusing one's self and cheering up!"

To this effect a passage is made directly to the following article, which regulates the participation of the members in the obsequies of a comrade—a singular beginning for a programme of entertainments!

THE PRESIDENT OF THE SOCIETY OF CENT KILOS IN THE SCALES.

Will everybody be obliged to attend funerals? Will one wear a crown? And with what inscription?

The discussion of this lugubrious subject continued for more than half an hour, the specter of death hovering over these congested faces and apoplectic necks. It was heartrending!

At length one of the members made this remark. He rose with great trouble, and, with the voice and gestures of an orator at a public meeting, pitched into the opposition:

"Fines if we do not attend funerals," exclaimed he. "Never! We want no rules nor discipline. We are a body of good livers and not an assembly of capitalists."

Another demanded a standing vote, as in the Chamber of Deputies, but his motion was not adopted because of the too laborious effort for some of the members.

Finally, the chapter of deaths was left, and the secretary read some letters of regret. One of the

signers was an undertaker's agent, and closed his missive with these words: "Think of me in case of death."

Again! . . . Decidedly, these big men are not wags.

Fortunately, the members arrived at a discussion of the uniform to be adopted for the coming outings, which will occur twice a year, in May and September. The president proposed a beribboned hat and a huge cane, and in the buttonhole a badge with the inscription "Cent Kilos" in gold letters.

During this discussion Mr. Mathieu explained the origin of the society to me.

"There were a few of us big men," said he, "whom accident sometimes brought together. Around us were springing up and increasing numerous sporting clubs which our obesity prevented us from joining. Everybody that we knew belonged to some association or other. We alone had the appearance of pariahs.

"One day we said to ourselves, Why should we not do as others do and form a group of our own?

"It was in this way that the Cent Kilos Society was born. I trust that a few celebrated men will join it and increase its eclat.

"Do you think, for example, that overtures made to Mr. Francisque Sarcey would have any chance of success? The eminent writer appears to me to possess the qualifications requisite for being enrolled as one of our members."

I answered that Mr. Sarcey did not seem to me to be exactly the man for this society, since he was a renegade and a false brother. In fact, far from being proud of his opulent person, "our uncle" blushed at his advantages, and not only did not wish to grow corpulent, but (oh, horrors!) has become a vegetarian in order to reduce his flesh.

This declaration has done for Mr. Sarcey forever in the estimation of the Cent Kilos. I trust he will forgive me!

But the hall is emptying, the floor is trembling under the weight of heavy steps, farewell is being said at the door, and the big men are leaving in taking up the entire width of the sidewalk. Their rounded backs and their thick necks gradually disappear, and, as they move off, they appear to be getting thin.—J. Chancel, in L'Illustration.

FRITILLARIA PLURIFLORA.

FRITILLARIA PLURIFLORA.

WE are indebted to Mr. Gumbleton for the privilege of illustrating this species. The illustration tells its own tale; but, for the convenience of the reader, we append the description from Watson's Flora of California, vol. ii:

F. Pluriflora, Torrey.—Bulb of large, thick scales, a half inch to an inch long; stem stout, a foot high or more, four to twelve flowered; leaves eight to fifteen, nearly covering the stem, somewhat verticillate, narrowly lanceolate, three or four inches long; flowers nodding on long pedicels, uniformly reddish-purple; segments somewhat spreading, nine to twelve lines long, oblanceolate; nectaries obscure; stamens unequal, six or seven lines long, shorter than the style; anthers two lines long.—Gardeners' Chronicle.

[Continued from SUPPLEMENT, No. 1115, page 17823.]

ELECTRO-GERMINATION.*

By ASA S. KINNEY.

IN the first series of experiments the seeds of white mustard (Brassica alba, Boiss.), red clover (Trifolium pratense, L.), rape (Brassica napus, L.), and barley (Hordeum vulgare, L.), were treated with an interrupted induced current from a Du Bois Reymond induction coil for a period of two minutes, the coil being connected with a four Leclanche cell battery. This was to determine the effect of different strengths of current upon germination and growth of radicles (roots). Two hundred seeds of each variety were taken. These were soaked in water for a period of twenty-four hours, after which each lot of 200 seeds was divided into eight lots of twenty-five seeds each. Seven of these lots were treated with different strengths of current in the apparatus shown in Fig. 2, as previously described.

These variations in current ranged from about 12 volts to a very small fraction of a volt, and were obtained by moving the secondary coil of the induction machine upon the graduated base. In the results the strength of current is represented by the distance in centimeters that the secondary coil was removed from the primary, the strongest current being at 1 centimeter, the weakest being at 17. In each case 25 seeds were left untreated and served as normal plants for comparison. After treatment, these seeds were sown in germinating pans, as shown in Fig. 5, which, after having been prepared for germination, were placed where the temperature was kept from 18° C. (64·4° F.) to 20° C. (68° F.) In the first series of experiments were used 32 lots of 25 seeds each, or in all, 800 seeds. Of these, 28 lots received treatment, while four were kept as normal to check the work. In the following tables will be seen an average of all the seeds treated, the first one giving the average length of radicles (roots) and the gain per cent. by treatment, while the second gives the average number of seeds germinating in 24, 48 and 72 hours respectively:

		Distance in centimeters of secondary coil from primary.						
	Normal.	1	3	5	7	11	15	17
Average length of roots....	2·24	2·79	2·82	2·96	3·10	3·13	2·94	2·72
Gain per cent. by treatment.... ...	0	24·55	25·89	32·14	38·39	39·77	31·25	21·42

It will be seen that there was quite a variation in the length of the radicles with the various strengths of current. As the secondary coil was removed from the primary, consequently weakening the current, there was a gradual increase in the length of radicles until an optimum effect was reached. From this point there was a gradual decrease, and had there been used a sufficiently weak current, there would have been found, without doubt, a point at which no effect could be seen.

In order to determine whether germination was hastened by treatment, an average was made of the total number of seeds germinated in 24, 48 and 72 hours respectively. The following table shows the result obtained by such an average:

		Treated.	Untreated.	Gain per cent. by treatment.
Average number seeds germinated in each lot in ...	24 hours	9·43	7·00	34·71
	48 hours	18·24	15·25	19·86
	72 hours	19·85	19·50	1·79

From these results it will be noticed that, by applying electricity, germination was considerably hastened and that those lots of seeds which received treatment gave a higher percentage of germination at close of experiment. This latter condition may be due to the fact that the treated seeds germinated more quickly than the normal, and there still remained in the normal seeds that which would have germinated had the experiment been conducted for a longer period of time; later experiments seemed to prove, however, that this was not the case, but that the electric current awakened life in some seeds that would have otherwise remained dormant.

A second series of experiments were carried out which were very similar in many respects to those already described, with the exception that, in this case, the young plants were allowed to grow for 96 hours, when the length was taken of both radicles (roots) and stems.

It will be noticed that, although the same four Leclanche cell battery was used as in the foregoing experiments, the optimum strength of current is at 5 centimeters instead of at 7, as in the first series. This is due to the battery having become weakened by too constant use, a fact which was readily noticed by the force of the vibrations of the Wagner hammer. It will also be noticed that the gain per cent. in radicles by use of electricity is not so high as in the first series. This seems to show quite conclusively that the beneficial effect of electrical stimulation, where applied but once, is very marked at first, but as the plant becomes matured this effect is partially, if not wholly, lost.

The following table gives an average of the lengths of all the roots and stems and the gain per cent. by treatment.

		Distance of secondary coil from primary, in centimeters.						
	Normal.	1	3	5	7	11	15	17
Average length of roots in centimeters....	4·08	4·44	4·58	4·63	4·53	4·45	4·19	4·13
Gain per cent. by treatment....	0	8·82	12·25	13·48	11·03	9·07	2·69	1·22
Average length of stems in centimeters....	3 11	3·23	3·46	3·47	3·40	3·33	3·28	3·14
Gain per cent. by treatment	0	3 54	11·25	11·57	9·32	7·07	5·46	0·97

A comparison of the growths of the stems and roots show that they both respond about alike to electrical stimulation. Although the gain per cent. is not so high in every case with stems as with roots, they follow in about the same proportion, and the optimum current is the same for both.

An average of the number of seeds germinated in the various lots in this series of experiments gives the following:

		Treated.	Untreated.	Gain per cent. by treatment.
Average number seed germinated in each lot in	24 hours	13·33	11·33	17·65
	48 hours	17·19	15·33	11·47
	72 hours	18·43	18·00	2·38
	96 hours	18·43	18·00	2·38

These results do not show so high a gain by use of electricity as in the first series, but prove that at the end of 72 hours all the seeds that retained vitality would germinate.

In the third series of experiments which were conducted, the seeds of white mustard, rape and red clover were treated with three different kinds of current. In each case the Leclanche battery was used, and when an interrupted induced current was employed, the secondary coil was placed at the point that showed the optimum effect in the foregoing experiments. An average of the results obtained in thirty-two experiments gives the following:

Kind of current.	Average growth (in centimeters) of radicles in 72 hours.	Gain per cent. by treatment.	Average growth (in centimeters) of radicles in 96 hours.	Gain per cent. by treatment.	Average growth (in centimeters) of hypocotyls in 96 hours.	Gain per cent. by treatment.
Normal....	1·95	0	4·00	0	2·96	0
Interrupted induced..	2·96	51·79	4·67	16·75	3·22	8·78
Interrupted induced 10 interruptions	2·93	50·25	4·52	13·00	3·13	5·74
Direct....	2·47	26·66	4·17	4·25	2·99	1·01

It will be noticed from these results that the interrupted induced current where ten interruptions were used gave the highest percentage of germination, but the experiments have not been repeated enough times to definitely ascertain whether this will always follow. It will also be noticed that the interrupted induced current where the Wagner hammer was used gave a much longer growth of radicles and hypocotyls, and, in fact, this form of current has given the best results in all the experiments which were carried out.

Where the direct current was used, the gain was not so high as with the other forms. These experiments and others which have been made since seem to prove

* Abstract of Bulletin No. 43 of the Hatch Experiment Station of the Massachusetts Agricultural College, Amherst, Mass.

that the optimum of strength of direct current is of somewhat lower voltage than with the induced current, and that the cause of the low gain per cent. in the tables is due to the fact that the optimum strength of direct current was not used.

Effects of hourly treatment on horse bean (Vicia faba, L.) and white lupine (Lupinus albus, L.):

Having satisfactorily determined that by stimulating the seeds before they were planted, an increase in the length of radicles could be obtained, the next question which presented itself was whether the growth of young plants could not be hastened by subjecting them, at intervals, to the influence of the electric current.

For this work the apparatus shown in Fig. 3 was selected, as it gave a good chance for examination of the radicles from time to time and in it the plants could easily be subjected to the electric current. One hundred seeds of the horse bean (Vicia faba) were sown in moist sawdust and allowed to remain there until the radicles had been pushed forth to a distance of about two centimeters, when they were removed. From the hundred seeds twenty-four were selected which seemed to nearest resemble each other. Upon the radicle of each of these was placed a dot of indelible ink one centimeter from the tip.

The glass funnels were filled with moist sand within about an inch of the top, as stated in the description of Fig. 3. Twelve small holes were made in the sand along the inner surface of each funnel and in each of these holes a bean radicle was placed, the bean itself resting upon the surface of the sand. This having been done the funnel was filled with sand, covering the beans to a depth of about one-half inch. The copper disks were placed upon the sand and the plants treated. Fig. 3 shows an apparatus set up in this way, the seeds in which received hourly stimulation lasting about thirty seconds for a period of forty-eight hours.

The disks of one funnel were attached to the poles of the induction machine, the secondary coil being removed five centimeters, and a current was passed through hourly from a four Leclanche cell battery during the experiment. Measurements were taken of the radicles twice daily, the dot of ink being a constant point from which the increase could be determined. In the following table is given the average increase of the twelve radicles in each funnel, the measurements being taken twice daily for two days. A column of percentages is also given, showing the gain by use of electrical stimulation.

Effect of hourly stimulation upon the growth of radicles of

HORSE BEAN (VICIA FABA).

Time.	Treated. Average increase in length of radicles in centimeters.	Untreated. Average increase in length of radicles in centimeters.	Gain per cent. by use of the electric current.
12 hours	1·87	1·57	19·11
24 hours	1·58	1·09	44·95
36 hours	2·53	1·78	42·13
48 hours	2·65	1·90	39·47

Having repeated the above experiment several times and obtained in each case practically the same results, it has been thought sufficient to publish but one table, which is a fair representation of the results of the experiments carried out in this line.

In this table it will be noticed that in the first twelve hours the gain by treatment is not so great as at subsequent periods, a fact which has been seen in all our other experiments in this line, but the cause of which has not been fully ascertained.

THE BEAR OF NORTHERN INDIA.

THE bear shown in our illustration, called Ursus labiatus, from its long lips, is, as the picture so plainly indicates, a timid and inoffensive creature ordinarily, though it will fight fiercely when wounded or in defense of its young. It is called the sloth bear from having the same character of jaws, wanting fore teeth and canines, from the early loss of the incisor teeth and the filling up of the sockets. It inhabits the high and mountainous regions of India, burrows in the earth, feeds on ants, rice and honey and lives in pairs together with its young, which, when alarmed, mount the back of the parent for safety. For our illustration we are indebted to the Zoologische Garten, Leipzig.

THE ASIATIC OR SLOTH BEAR.

ECONOMIC ORNITHOLOGY—BIRDS IN THEIR RELATION TO MAN.*

THE subject is divisible into the following heads: Benefits man derives from birds; injuries birds inflict upon man; and man's influence upon bird life.

BENEFITS MAN DERIVES FROM BIRDS.

Man derives from birds, food, clothing and ornament and the advantage of the destruction they occasion to insects and mammals hurtful to crops.

Chickens, ducks and geese have contributed to man's food supply since the earliest historic times. Chickens are supposed to have descended from the red jungle fowl of India. In the case of the domestic duck, the wild mallard is the parent bird. The mallard breeds throughout the northern parts of both eastern and western hemispheres and is still one of our prominent game birds. The guinea fowl was originally a native of Africa. The Abyssinian guinea fowl approaches the domestic bird as nearly as any. The pigeon is supposed to be descended from the blue rock pigeon of Europe. Geese are derived from the wild goose found now on the northern coasts of Europe; while the turkey has been domesticated much more recently than any of the others; although now its value as a food bird is as great as any of these mentioned. The turkey is a native of America.

It is not fully settled whence the original stock of turkeys came. There are several recognized varieties in different parts of America—one in Florida, one in Mexico, one in Texas and the other in the northeastern United States. The domestic turkey resembles more closely the turkey of Mexico than any of the others; and it seems probable that some of the early expeditions to Mexico at the time of the conquest brought the first specimens of turkeys to the Indians. Domestic turkeys have become almost world wide in their distribution.

BIRDS THE FARMERS' FRIENDS.

When nature is undisturbed there has been kept up a balance between plants and insect life mainly by birds which constitute Nature's great check upon the excessive increase of insects. By the progress of agriculture man brings together in one area great quantities of certain plants which he uses for food, and in this way furnishes abundant food for certain insects which often seriously affect the profits of these crops; so that we largely lose the balance which Nature would maintain, and some means should be taken to increase the number of birds; whereas, on the contrary, the tendency of man has been to destroy the birds, and in that way we can account for the immense damage done every now and then by great myriads of noxious insects.

The actual benefit birds render to man in destroying insects of all sorts cannot be estimated. It is roughly estimated that there are about ten times as many species of insects in the world as there are species of all other kinds of animal combined—mammals, birds, reptiles, shell fish and all the various marine forms of life put together; and some writers estimate that the number is twice as great, or twenty times as many as all the other forms of animals.

Of the aphides (plant lice), one, during our ordinary summer, will become the progenitor of thirteen generations from the opening of spring until the winter kills them off again; and as a rule, there are 100 young in a brood. By calculation of the enormous increase, an estimate has been made of the actual number of these insects that do come to maturity and are liable to be injurious to vegetation.

A prominent entomologist some time ago was investigating a small cherry tree which was very deeply infested with these aphides. He counted the number on a series of leaves on a branch and then estimated the number of leaves on each small branch; the number of small branches on the large branches; until he formed an idea of the number of insects on the whole tree; and on that average sized cherry tree there were about 12,000,000 of these lice.

As to the amount of vegetable matter insects consume, it is calculated that an ordinary caterpillar will increase in thirty days from the time it hatches from the egg, about 10,000 times its own size. If the increase of the human body during natural lifetime were in the same ratio as the caterpillar's, man would, at the age of maturity, weigh forty tons. This gives an idea of the enormous rate of growth of caterpillars, and, proportionately, the enormous amount of food which they consume.

It has been estimated that about 10,000 caterpillars could very easily destroy every blade of grass in an acre of cultivated ground; and by one who has seen the ravages of potato bugs or army worms and grasshoppers in the West, the way in which these noxious insects can totally destroy the vegetable matter over immense areas can be readily appreciated.

It has been calculated there are about 700 to 1,000 individual birds to be found in every square mile of rural country district. Suppose each bird consumes about fifty insects during the day (a very moderate estimate, because parent birds visiting their young do so a hundred times a day and each time bring an insect or some article of food, according to the nature of the bird); at this rate of figuring, 750 birds to a square mile, with fifty insects per bird per day, in the State of Pennsylvania in a day there will be consumed 1,760,000,000 insects, or, in the course of six months, 316,800,000,000 insects. Though probably a very moderate estimate, this will afford some idea of the immense benefit man derives from the birds agriculturally.

Many birds considered injurious to man will, on careful examination, tell a different story. The common crow blackbird—known also as the purple grackle—common in Pennsylvania, arrives from its wintering grounds in numbers about February 1, gradually increasing in numbers, occurring all through the Middle New England and Southern States. This bird has a bad name among the farmers, because it pulls up the seed corn and later on feeds on the mature corn and to a certain extent on fruits; therefore, the farmers everywhere are down on the blackbirds. Some years ago, however, a government bureau in Washington was directed to investigate the food habits of birds; and an immense number of stomachs were secured and then bottled in alcohol and studied under the microscope, and the proportion of animal and vegetable material, also the exact species of plants and insects that were contained, in a great many cases has been ascertained.

* Condensed for the SCIENTIFIC AMERICAN from a lecture at the Academy of Natural Sciences, Philadelphia, by Prof. Witmer Stone, Curator of the Ornithological Section.

It was found in the case of the blackbird that fully one-half of its food consisted of insects. In the case of the young blackbirds, they, for several weeks, are fed entirely on insects. The gizzard of the young blackbird does not develop the heavy thick coating of the adult blackbird for quite a time; and it would be impossible for it to digest corn and wheat until it becomes almost an adult bird. The first food of the young blackbird is almost invariably spiders; then larger, soft insects; finally, the several kinds of beetles.

Hawks and owls have been badly misjudged. Farmers shoot them on sight, sure that they do a great deal of mischief. Investigation by the Department of Agriculture shows that out of seventy-three species of hawks and owls in the United States, there are only five really injurious to agriculture. In all the others the proportion of noxious insects in their food is very much in excess of the percentage of poultry. In the case of a lot of our common hawks there were 2,212 stomachs examined during 1895; and these contained in their food supply 56 per cent. of field mice (very injurious to all sorts of crops), 27 per cent. of noxious insects and 3½ per cent. consisted of poultry.

The chicken hawk (the common red-tailed hawk) is a great friend, instead of an enemy, to the farmers, rarely carrying off any chickens and feeding almost exclusively on field mice and grasshoppers. In an examination of 562 stomachs of red-tailed hawks, 278 of them contained mice; 171 others, small mammals; 47 noxious insects; and 54 poultry. Then again, the actual contents of these 562 stomachs were the remains of 40 small birds, 13 chickens, 52 mice and several thousand insects. This shows for every chicken taken 50 mice and probably as many as 1,000 or 2,000 noxious insects, which considerably more than offsets the loss of a single chicken to the farmer.

Notwithstanding the above favorable showing, laws have been continually passed in Pennsylvania offering bounties for the slaughter of hawks and owls; hence, numbers of these birds have been killed and the State has paid out thousands of dollars to the gunners not only of Pennsylvania but adjoining States, whence the gunners bring in the scalps and claim and secure the bounties offered in Pennsylvania; furthermore, the heads and scalps of other small birds which are not hawks and owls at all—such as whippoorwills, night hawks and other such birds—are brought in to our county authorities, who are a good deal more politicians than ornithologists. Heads of old stuffed parrots, that were somewhat painted up and stained and appeared bloody, are said to have fetched bounties just the same as the heads of hawks and owls.

These laws are still in force in some States, and in very few States is there any law protecting hawks and owls. The United States Department of Agriculture has circulated thousands and thousands of these reports yet they seem to have almost no effect upon the farmers at large. The legislature of Pennsylvania passed a law some years ago protecting hawks and owls. It was in operation for one session. In the next session a bill was introduced legalizing the killing of hawks and owls—showing the impossibility, almost, of keeping laws of this kind in force in the face of the popular prejudice against these birds.

BIRDS THE FARMERS' ENEMIES.

Some birds indisputably destroy considerable quantities of ripened grain, fruits and berries, such as the red winged blackbird. Crows undoubtedly destroy a great deal of grain; but in the case of the blackbird he does quite as much good as harm. The Baltimore oriole destroys considerable quantities of grapes in certain sections of country, but he is very largely an insectivorous bird at other times, when he subsists almost exclusively on insects.

While the red headed woodpecker feeds in summer almost entirely on insects, during certain seasons he does considerable damage to raspberry and blackberry crops.

The reed bird passes to the south just about the time the rice crops are ripe and consumes vast quantities of rice.

The robin and the cedar bird are, during part of the year, very injurious to cherry crops; but as a rule there are very few of these birds but that amply make up for the damages to the crops by the insects they destroy at other times of year.

The great horned owl and Cooper's hawk do destroy considerable quantities of poultry.

The kingfisher and blue heron are injurious to fishponds on whose banks they take up their abode and kill great numbers of small fish put there for hatching purposes.

MAN'S INFLUENCE ON BIRD LIFE

has always been to the destruction of birds. Man kills all species which do him real or imaginary harm. He kills all from which he can derive direct benefit as food or ornamentation; and causes great diminution in a number of birds by the general advance of civilization.

In the case of the Allegheny Mountains we find in almost every remnant of hemlock forest numbers of northern birds such as abound in the Catskills and Adirondacks; and some years ago, when the hemlock forests of Pennsylvania extended further south, these northern birds were undoubtedly vastly more numerous. At the present day, considering the great destruction of forests going on in Pennsylvania, the northern birds are being rapidly exterminated; and it will be only a few years before a number of these species will be absolutely unknown as breeding birds in Pennsylvania.

PROTECT OUR FEATHERED GUESTS.

It will be universally admitted that the protection of birds in general is desirable. Man has always shown a care to prevent the extermination of nesting birds which he uses for food purposes; no farmer would believe in killing off all his chickens and ducks for the momentary gain. He always leaves a certain number of breeding birds to provide for another year.

In the protection of the herons and birds used for millinery purposes the laws seem to have very little effect at present, probably because they are not enforced, there being no provision in Pennsylvania for game wardens. The law is very strict for the preservation of insectivorous birds, but scarcely any one is prosecuted or arrested for violating the law. Persons shoot them with impunity.

In New Jersey they have a large force of salaried game wardens appointed by the legislature, and the present chief of the game commission is an excellent officer; so that they watch very closely the destruction of all sorts of small insectivorous birds out of season; and they arrest and prosecute fifty to sixty persons every month in the State of New Jersey.

One of the methods recently started for bird protection through general education on birds was the founding of "Audubon Societies." There have been Audubon Societies founded for the past ten years. At first, they were societies which organized exclusively against the sale of feathers for millinery purposes. These societies were almost too large and far reaching—they tried to include members from all parts of the Union and became too unwieldy; but more recently the societies have been formed in each State independently, which not only try to discourage the sale of feathers and plumes for millinery purposes but also to enforce good game laws, and try to do what they can for the general education of the public in matters ornithological; and it is to be hoped these societies will eventually contribute a little to the general love of birds which will do away with the immense slaughter which has taken place in the past.

GALVANIC PLATING OF ALUMINUM.

Up to the present time the plating of aluminum has not been perfectly satisfactory, partly because of the nature of the baths employed, which attack the metal, but more especially because of a thin pellicle of the metal which prevents a perfect contact with the main body, says the Western Electrician. Copper, deposited on aluminum by electricity in a copper sulphate bath, often scales off on the least flexion of the piece, or under the pressure of the burnisher. This covering of aluminum with copper possesses a peculiar interest, inasmuch as on this latter metal the deposition of silver, gold or nickel is easy of accomplishment. The lighter metal is especially valuable for a wide variety of uses in the manufacture of articles of luxury or convenience, and will be gladly accepted if presented under a more agreeable aspect, and free from the oxidation which is the result of exposure to the air. This problem may be solved by strict adherence to the following plan, according to La Métallurgie:

Having cleaned the aluminum in ordinary hydrochloric acid, or better, in a warm, slightly concentrated solution of this acid, and afterward plunging it in a copper sulphate bath, a considerable amount of gas is disengaged and the aluminum is instantaneously covered by a coating of spongy copper which is not thoroughly adherent.

The same fact is not noticed if the metal is plunged into the copper solution without the previous acid treatment. It is not the same if the object is treated in the following manner.

The article to be coppered should be of pure aluminum and thoroughly cleaned in a hot solution of alkaline carbonate—soda or potash—and rendered porous and striated. This condition of porosity is essential to a perfect adherence of the copper.

The article is next washed thoroughly, carefully cleaned and brushed; then placed for a few moments in a hot one-tenth to one-twentieth solution of hydrochloric acid. This acid will attack the metal, covering it with a chloride of aluminum which prevents oxidation. It is then immersed a very short time in a water bath. The excess of acid having been thus removed, it is now immersed in a slightly acidulated and concentrated solution of copper sulphate, while, with an abundant escape of gas, a beautiful and firmly adherent deposit of copper will be accomplished. This first deposit may in many cases be abundant, but it may be intensified by the electric current. The two operations may be performed at the same time, by connecting the electrical source when the article is first immersed. Nevertheless it is preferable to treat it by the two operations. Aluminum is not sensibly attacked when cold, by pure or dilute sulphuric acid, even in the presence of another metal, and does not precipitate the copper from sulphate like cast iron, zinc and some other metals.

The phenomena are entirely different when the surface of the aluminum retains traces of free chlorine or chlorine in combination with the metal. The chlorine possibly acts as an intermediate vehicle, which by reaction assists in the plating process. The chemical changes may be said to be that the chloride of aluminum is decomposed by the sulphuric acid, forming a sulphate of aluminum, which is in turn dissolved, the chlorine is freed, and the copper is deposited upon the now thoroughly pure metallic surface, solidly and smoothly. This bath should not be too far prolonged, as the evolution of gas consequent on too long an immersion will tend to raise scales of copper, and damage the work. The first layer, obtained in a few seconds by simply dipping, should be carefully washed in running water before placing the object in the electrolytic bath.

Copper aluminum (six per cent. copper), utilized where greater strength is required, may also be as readily coppered as the pure metal. This should be cleaned in hot dilute nitric acid, which gives it a beautiful and remarkably white surface. It will now accept a copper covering by simple immersion in the copper sulphate, after dipping in the hydrochloric bath, but this metal also will act satisfactorily in the electrolytic bath.

Curious phenomena are mentioned by Van der Weyde, who noticed that in a bath with an anode of copper and a cathode of aluminum the resistance is the same as though both poles were of copper, the intensity of the current depending on the number of elements and the resistance of the bath; while, on reversing the current, the oxygen liberated from a pellicle offers such resistance as to almost entirely stop the current flow.

In the casting of bells of large size for chimes or given tones the skill and secret of success lie in getting the thickness of the ring which is at the mouth of the bell just right. It will be noticed that just a little back from the edge of the bell, on the flange, the metal is thicker than in any other portion. The maker, in order to get the desired tone, makes a drawing of the bell, and in a cross section of this thicker ring describes a circle, the diameter of which determines the tone.

SELECTED FORMULÆ.

Cement for Bicycle Tires.—

(1) Isinglass .... ½ oz. av.
Gutta percha .... ½ "
Caoutchouc .... 1 "
Carbon disulphide .... 4 fl. oz.

Mix and dissolve.

(2) Shellac .... 2 oz. av.
Gutta percha .... 2 "
Red lead .... 90 grains.
Sulphur .... 90 "

Melt the shellac and gutta percha and add, with constant stirring, the red lead and sulphur, melted. Use while hot.

(3) Caoutchouc .... 2 oz. av.
Resin .... 140 grains.
Shellac .... 100 "

Carbon disulphide, a sufficient quantity to dissolve the other ingredients.

(4) Crude rubber .... ½ oz.
Carbon disulphide .... 4 "

Macerate 24 hours, and then add a solution of—

Resin .... 1 oz.
Beeswax .... ¼ "
Carbon disulphide .... 4 "

Retouching Medium for Small Surfaces.—

Gum dammar .... 6 parts.
Gum resin .... 9 "
Oil of turpentine .... 120 "

Erasive Soap.—Try one of the following from the Era Formulary:

(1) White soap .... 12 oz.
Borax .... 1 "
Salts of tartar .... 1 dr.
Oil of sassafras .... 1 "
Water .... 8 oz.

Cut the soap in shavings and dissolve in the water by the heat of a water bath, add the borax and salts of tartar and boil till reduced to one pound; then, while cooling, add the oil of sassafras, and make into cakes of about two ounces.

(2) Fuller's earth .... 15 parts.
French chalk .... ½ "
Yellow soap .... 10 "
Pearl ash .... 8 "

Mix thoroughly and make into a paste with spirits of turpentine. Color if desired. Form into cakes. A little of this detergent is scraped off with a knife and made into a paste with water and applied to the clothing.—Pharmaceutical Era.

Brown Hair Dyes.—

(1) Dissolve 8 parts pyrogallic acid in 16 parts of alcohol and mix with a solution of 1 part of sulphide of sodium in 48 parts of water.

(2) Lead acetate .... 2 dr.
Sodium hyposulphite .... 1 oz.
Rose water .... 14 "
Glycerine .... 2 "

Dissolve the lead acetate and sodium hyposulphite in separate portions of the rose water, filter separately, mix the solutions, and add the glycerine.

(3) Chestnut Brown Hair Dye:

Pyrogallic acid .... 1 dr.
Chloride of copper .... 2 "
Nitric acid .... 5 drops.
Distilled water .... 6 oz.

Make a solution.—From Era Formulary in the Pharmaceutical Era.

Flashlight Powder.—

(1) Magnesium powder .... 6 ounces.
Potassium chlorate .... 12 "
Antimony sulphide .... 2 "

Mix them. Use from 75 to 150 grains of the mixture at a time.

(2) Purchase 1 ounce magnesium powder and 1 ounce of negative gun cotton from dealers in photographic material; place on a dustpan enough cotton when pulled out to measure 3½ inches in diameter. Sprinkle it over with 20 grains of magnesium powder, to form a thin, even film. Lay over the magnesium thus arranged a very thin layer of gun cotton. Connect to the bunch of cotton a small fuse of twisted cotton about 6 inches long, so that it will extend to the side of the dustpan. Then set the pan on a step ladder near the object, and, when ready, light the gun cotton fuse with a match, when instantly a brilliant flash will ensue.

(3) Chlorate potassium .... 25 parts.
Yellow prussiate potassium .... 3 "
Sugar .... 2 "
Aluminum powder .... 10 "

The reader should be warned that potassium chlorate is very explosive, and there have been many fatal accidents to experimenters on flash light powders. It is, perhaps, as well for the amateur not to experiment in this direction, as flash light powders of the best quality can now be purchased at moderate rates.—Pharmaceutical Era.

Tonic Celery Compound.—

Celery seed .... 384 grains.
German chamomile .... 384 "
Gentian root,
Wahoo bark,
Angelica root, of each .... 2 drachms.
Catnip herb,
Buchu leaves,
Dandelion root,
Columbo root, of each .... 4 "
Wild ginger,
Mandrake, of each .... 1 "
Glycerin .... 1 ounce.
Simple elixir to make .... 1 pint.

Reduce the drugs to required fineness, percolate with diluted alcohol until 6 ounces of percolate have been obtained; add 2 ounces simple elixir; let stand 24 hours; filter, add glycerin and enough elixir to make 1 pint. A pleasant medicinal tonic, when given in doses of one-half tablespoonful before each meal.—American Druggist.

ENGINEERING NOTES.

Japan, within five months of taking possession of Formosa, has built two lines of Decauville railroads; one 35 miles long and one 50 miles long.

A copper pan, said to be the largest ever made from one piece of metal, has been turned out at Swansea, England. It is 12 feet 4 inches in diameter, 3 feet 3 inches deep, and weighs two tons.

Hammers are represented on the monuments of Egypt, twenty centuries before our era. They greatly resembled the hammers now in use, save that there were no claws on the back for the extraction of nails. The first hammer was undoubtedly a stone held in the hand. Claw hammers were invented some time during the middle ages. Illuminated manuscripts of the eleventh century represent carpenters with claw hammers. Hammers are of all sizes, from the dainty instruments used by the jeweler, which weigh less than half an ounce, to the gigantic fifty ton hammer of ship building establishments, some of which weigh as much as fifty tons and have a falling force of from ninety to one hundred. Every trade has its own hammer and its own way of using it.

A detailed account has been given to the public by Prof. C. H. Benjamin, of the Case School of Applied Science, at Cleveland, O., of his recent experiments in determining the loss of power through friction in the transmission by belts and shafting. These observations were made in sixteen factories, each engaged in a different kind of work. He records the most startling loss to have been found in a bridge material factory, where the shops were spread over a lot of ground; 80 per cent. of the engine's power was lost in the shafting there. In a planing mill the loss was 73 per cent., and in a sewing machine factory it was nearly 70 per cent.; it was 77 per cent. in a stamping mill and 65 per cent. in a boiler and machine works. The average loss for heavy machine shops was a little in excess of 62 per cent.; the average for light machine work was about 55 per cent.

The British turreted whaleback steamer Oak Branch, which excited so much interest while in New York harbor a few months ago because of her peculiar construction, had a remarkable experience recently on a voyage from Shanghai to Sydney, in water ballast. The story comes from the commander of the Mariposa, who saw the Oak Branch in Sydney harbor just before he sailed. It appears that the big steamer lost her propeller and shaft in midocean, and lay helpless in not the best of weather. There was an additional propeller and shaft aboard and her engineer set about to make repairs. The ballast aft was pumped out and forward tanks filled. Then the extra shaft and propeller was swung over and fitted into place. The job required eight days, during which the weather was bad and the sharks worse. The steamer proceeded on her voyage, arriving safely at Sydney.

A short time ago reports were current in the railway papers that the Mexican International Railroad had lost \$200,000 through the burning of its repair shops at Piedras Negras, but the impression that the fine equipment of machine tools were completely ruined was found to be erroneous. The fire had got well started before the fire department was ready to begin operations. The superintendent, Mr. Jennings, saw that it was impossible to save the building, so he gave orders that no water should be thrown on the fire, and set all of the men available to work shoveling sand and earth upon the glowing embers, care being taken to smother the fine machine tools. The non conducting material thus employed made the tools cool slowly and very few of them were found to be warped when they were cleaned off. A temporary shop was shortly erected and nearly all the tools worked as satisfactorily as before the fire. Had water been applied to the fire, most of the tools would have been ruined.

The gelatine substitute for glass called tectorium has been found very satisfactory in practice in Germany, for the following reasons: (1) It can be bent without being broken; (2) it is both tough and flexible; (3) is not softened by the rays of the sun; (4) is non-soluble; (5) is not affected by severe cold; (6) is a bad conductor of heat; (7) is well adapted for roofs, on account of its extreme lightness; (8) when exposed to the sun it loses its original yellowish color in time and becomes harder and more durable; (9) can be made, by a very cheap process, to imitate stained glass in such manner that it cannot be distinguished from the genuine article; (10) can be cut by shears, nailed to wood, and transported without danger; (11) can be easily repaired in case it is cut; (12) does not break; and (13) is well adapted for factory windows and skylights for hothouses, market halls, verandas, transportable buildings, and for roofing. The consuls state that it is sold in small quantities in a few places, but that it is not known to the general public and as a commercial product is still an experiment.

A three hinged beton arch bridge has been built over the Danube, at Inzigkofen, in the principality of Hohenzollern, says Engineering News. It was constructed in 1896 to replace a wooden bridge carried away by a flood in 1893. This new bridge has a span of 141 ft., and a rise of 14·36 ft. above the bottom hinges. The beton foundation starts from the rock on one side and from a 20 ft. bed of hard gravel on the other side. The width of the bridge, between parapets, is only 12·46 ft., allowing for a single driveway and two 2 ft. footways. Cast iron hinges were used at the spring and at the center of the arch, to provide against the danger from rupture when the centers were struck and against movement due to variations of temperature. The centers were supported on sand boxes resting upon clumps of piles, and the beton was from 3·28 to 4·26 ft. thick, perpendicular to the line of pressure, deposited in thin layers and divided into voussoirs with a width about equal to the thickness of the arch. Upon striking the centers the arch sank only 0·3 in. at the crown, and the bridge was finally tested by passing over it a road roller weighing 7,700 lb. The whole bridge was built in four months, of which 2½ months were consumed in depositing the beton, and the total cost of the structure was \$6,650, with a total volume of 824 cu. yds. of beton and masonry. This bridge is fully described and illustrated in Le Genie Civil for April 3, 1897.

ELECTRICAL NOTES.

The recent discussion on the amount of power consumed in electrically heating a street car, which has taken place in the Street Railway Journal, of New York, has led the manager of the Schuylkill Valley Traction Company, of Norristown, U. S. A., to fit up a car with measuring instruments for an experimental run. It was found that in average circumstances the power consumed in heating a car is equal to from 20 to 22 per cent. of the power required for propulsion, or about 5 horse power for a car of ordinary American pattern.

Pine forests are an important matter in Scandinavia and telegraph poles an article of export, says the English Electrical Engineer. It has been remarked there by Mr. Petersen that in early times it was customary to prepare the wood to be used for posts in the summer of the year before the tree was cut down by cutting off the bark for 10 feet to 12 feet. The result of this was that the trunk, and especially the lower part, became more rich in resins, which increased its resistance to decay. Such a process, it is suggested, would increase the life of telegraph poles perceptibly without increasing their cost.

Prof. W. E. Ayrton, in a recent interesting lecture, in London, on submarine telegraphy, ventured the following remarks concerning the future: "There is no doubt the day will come, may be when you and I are forgotten, when copper wires, gutta percha coverings and iron sheathings will be relegated to the museum of antiquities. Then when a person wants to telegraph to a friend, he knows not where, he will call in an electromagnetic voice, which will be heard loud by him who has the electromagnetic ear, but will be silent to every one else. He will call, 'Where are you?' and the reply will come loud to the man with the electromagnetic ear, 'I am at the bottom of the coal mine, or crossing the Andes, or in the middle of the Pacific.' Or, perhaps, no voice will come at all, and he may then expect the friend is dead. Think what that will mean. Think of the calling which goes on from room to room, then think of that calling when it extends from pole to pole—a calling quite audible to him who wants to hear, absolutely silent to him who does not."

A system for the automatic lighting and extinguishment of gas jets from a distance is said to be in practical operation at Aix-les-Bains, France, having been developed by Mr. Egraz, director of the local gas works, and others. Until last June the matter was still in an experimental stage, but since then the system has been installed in a section of the place named. The gas supply to each of the various burners in the system is controlled by an electric current acting on a special piece of inoxidizable steel, resting by its weight on a seat in such a way as to close the orifice to the burner. The steel is moved to turn the gas on or off by magnetizing or demagnetizing, and in case of turning on the gas is lighted in the same time by either a spark or the incandescence of a special practically infusible material. The system is of course applicable to buildings, in which, or elsewhere, a portion of the lamps in one series may be lighted at one time and others later, by varying currents. Those interested in further details of this system will find more information in the American Gas Light Journal for April 26, 1897.

Forty passengers on a trolley car on the North Hudson County Railway had a narrow escape from death recently in the Hillside road leading down the bluff from West Hoboken, N. J., says the Western Electrician. The trolley road at that point winds down the hill to the ferry. From the top of the bluff to the level of Hoboken is a sheer fall of more than 300 feet. The car, crowded with guests returning from a reception, had gone down the incline a short distance when the motorman saw something dark on the track. He quickly applied the brakes, but the front axle struck the object with such force as to throw the forward wheels from the tracks. The car then shot toward the edge of the bluff overhanging the abyss. Both the motorman and the conductor applied brakes, and the car was stopped when only a few feet from the edge of the bluff. The motorman fainted when the danger was over, and several passengers were so overcome that they were unable for some time to proceed. The cause of the accident was a large bowlder which had fallen on the track from the overhanging cliff. The front of the car was wrecked, and traffic was stopped for several hours.

An experiment in connection with electric traction is about to be made by the Belgian State Railway on a line 9 miles in length, extending from Brussels to Tervueren. According to L'Electricien, five large accumulator cars will be run in addition to the present steam service. They are to run at a speed of 18¾ miles an hour on the steepest gradient—1·6 per cent.—and at 31 miles an hour on other parts of the line. Each car will be 52¼ feet long and will rest on two bogies. There will be room for 80 passengers. The cars are direct driven, and there are two motors on each. The motors will weigh from 8 to 9 tons, the other electrical apparatus 1 ton, the cells 12 tons, and the car 20 tons. Three Julien and two Tudor batteries have been ordered, each of 264 cells. The former are designed to make three or perhaps four journeys without recharging, the latter only one journey. In the latter case, however, the time required for charging is limited to one hour, while for the Julien battery six hours are required. The cells are in 24 drawers, 11 being contained in an ebonite box in each drawer. The following firms are supplying motors for these trials: Jaspar, of Liège; Pieper, of Liège; Schuckert, of Nuremberg; and Thury, of Geneva. The motors will be compound wound and connected long shunt, the winding in series with the armature constituting part of the starting resistance. The following are some of the conditions specified for the motors, says the Iron Age. At a pressure of 500 volts the two motors of a car when connected in series shall revolve at 116 revolutions per minute, when the current is 15 amperes and the field magnets are only excited by the shunt winding. Under these conditions they shall have an efficiency of at least 75 per cent. When connected in parallel at 500 volts, with the maximum excitation obtainable by the shunt alone, and a total current of 150 amperes, the motors shall make 231 revolutions per minute, and the commercial efficiency shall not be less than 80 per cent. The cells will be charged by a Willans engine and dynamo, erected on a car drawn by an old locomotive.

MISCELLANEOUS NOTES.

The roller skate was invented seventy-three years ago. It attracted public attention by the use it was given on the stage in 1849, in Meyerbeer's opera "The Prophet."—Der Stein der Weisen.

An automobile parade, known as the Longchamps Fleuri Automobile, took place in Paris recently in, unfortunately, rather inclement weather. About thirty vehicles, all gayly decorated, joined in the promenade.

An ingenious device to prevent the clouding of dental mirrors, which is, of course, equally applicable to the mirrors used in throat and nose work, has been made known by an English dentist, Mr. George Wallis, says the Medical Record. This consists simply in smearing the surface of the mirror with soap and then polishing it with a dry cloth. If this is done, the troublesome warming of the laryngoscope over a lamp is entirely unnecessary. This method has long been used by housewives for polishing mirrors, but we do not know of its ever having been employed by laryngologists.

Brussels has simply gone wild over the project of converting itself into a seaport. Not only the people, but the authorities as well, seem to take it for granted that the moment the ship canal connecting the city with the coast is open to navigation, all maritime traffic will at once abandon the port of Antwerp for the capital. To such a degree, indeed, have the citizens of Brussels lost their heads that the municipal council have passed a resolution for the construction of a huge electric lighthouse in the center of the city on the Place de Brouckere, to serve as a beacon to ocean steamers as well as for an ornament to the city. —New York Tribune.

The Peruvian government has decided to establish a permanent exhibition of machinery at Lima. The exhibition will be held in the machinery hall of the exposition palace and will be opened July 28, 1897. Imported articles destined for this exhibition, which are not exempted from duty, will be admitted free of duty through the various custom houses of the country upon the production of a bond guaranteeing the payment of the duties ordinarily levied upon such articles when they are not reshipped within a period of six months. The exhibition of the same article will not be allowed for more than six months without special permission of the Peruvian government.

A Washington dispatch says: "The fact has been recognized among metal workers that the sole obstacle to the wide use of aluminum was its high cost as compared with other useful metals. Therefore it will be good news to learn through United States Consul Germain, at Zurich, that in a short time, probably within a year, the price of this metal will fall to about 27 cents per pound, so that but three commercial metals will be cheaper than aluminum, namely, iron, lead and zinc. The consul bases this statement upon the figures he has collected, showing the production of aluminum and the prospective increase of the plants. Last year the output was 14,740 pounds daily, of which 4,193 pounds daily were produced in the United States. This year the plants will be increased to bring the daily product up to 42,460 pounds."

In a recently patented process, says the Mining and Scientific Press, San Francisco, a thin film of gutta percha is applied to a sheet of paper or fabric, and when the surface thus covered is laid on another surface and submitted to heat and pressure a union is effected by the melting of the gutta percha, which when cool again joins the two surfaces strongly and effectually. It can be used advantageously in bookbinding, backing and mounting paper, making card and mill board, paste board, etc., and mounting photographic and other prints. Sensitized photograph papers thus coated on their posterior sides may be used like ordinary sensitized papers, the gutta percha having no effect on the chemical baths. These products preserve their adhesive properties indefinitely under the influence of high temperature. This device has for a long time been used by tailors as a cloth cement.

The Elizabethan style of architecture is characterized by orders very inaccurately and rudely profiled; by arcades whose openings are often extravagantly wide, their height not unfrequently running into the entablature. The columns on the piers are almost universally on pedestals, and are often banded in courses of circular or square blocks at intervals of their height; when square they are constantly decorated with prismatic railings, in imitation of precious stones, a species of ornament which is of frequent occurrence. Nothing like unbroken entablatures appear; all is frittered away into small parts, especially in scrolls for the reception of inscriptions, which at their extremities are voluted and curled up. All these eccentricities are so concentrated in their sepulchral monuments that no better insight into the leading principles of the style can be afforded than the monument of Queen Elizabeth herself, in Westminster Abbey.

Consul Monaghan sends the State Department a copy of an ordinance which relates to foreign commercial travelers in Germany. If they carry the goods with them that they sell, or if they solicit orders from others than merchants or manufacturers without express previous request, they must comply with certain regulations enforced as to peddling. Those who do business traveling from town to town are required to take out a license. Foreigners who import and sell farm and garden products—fruit, eggs, poultry, beeswax and honey—are not required to be licensed, but there are many grounds upon which they may be refused the right to carry on their business. Persons may be prevented from trading who suffer from contagious disease or are disfigured repulsively; who are under police surveillance, or are drunkards or vagrants; who have been in prison for any criminal act or misdemeanor for three months; who have ever been punished for violation of peddling ordinances, and who are under twenty-five years of age, unless married and supporting a family. Commercial travelers who hold special licenses as specified in treaties are subject to all stipulations of the treaties, and this license entitles the holder to carry on business throughout Germany, after the payment of certain fees, dues and taxes.

THE TESTING OF INDICATOR SPRINGS.

The value of an indicator will be determined above everything else by the accuracy with which the indicator spring is tested. The slightest inaccuracy by the maker in recording its strength will produce serious error in the determination of the horse power of any engine to which it is attached. For many years it was customary to test the springs by dead weight and when they were cold. In the days of low pressure steam this method was fairly accurate, but with the advent of multiple expansion engines and high pressure steam, with its relatively high temperature, a change of method was necessary. The increased temperature weakens the spring so that the scale will not agree with that recorded when the spring was cold. Moreover, it is now the custom to have the indicator piston slightly leaky, in order to decrease friction, and the leakage of two pistons will never be absolutely the same.

These considerations of temperature and leakage make it evident that the only way to properly calibrate an indicator is to do it under steam pressure.

The naval engineers originated the method of testing indicators for each 5 or 10 pounds pressure, both with rising and falling pressures. Since there is always some friction, the line made by the pencil under a falling pressure is never exactly the same as with a rising pressure of the same amount. By testing to show this difference it is possible to get a mean reading which will be very accurate.

We have been favored by the American Steam Gauge Company with an account of their method of testing indicators directly from a mercury column, by a very ingenious arrangement which gives automatic readings. Their apparatus, which is shown in Figs. 1, 2 and 3, was designed by Engineer W. D. Weaver, of the United States navy.

Referring to Figs. 1 and 2, the manifold, A, is a cylinder 5 feet long and 4 inches internal diameter, with four cocks for attaching indicators. Steam is admitted into a separator—it is necessary to have the steam as dry as possible—through valve, B, into manifold, and is released through valve, through which also the water which collects in the separator is released. Communication with the mercury column is made through valve, D, steam pipe, E, and a water cylinder (in which the water is kept at a constant level by connection to a steam trap), and the pipe to the mercury reservoir. At intervals equal to the height of column of mercury at 70 degrees F., which will exert a pressure of 5 pounds per unit area at its base, insulated points are inserted in the column. The manifold and pipe are carefully lagged to prevent condensation, and the mercury reservoir and column are inclosed in a funnel through which the air circulates and keeps all parts of the column at the same temperature. The gage, G, is used only as a guide to indicate the height and regulate the velocity of the mercury.

The mechanism for applying the pencil and "pulling the string" is arranged as follows: An arm on shaft, H, is connected by a lever to a post in front of the shaft. On the short or upper end of the lever is attached a link which is connected to the pencil lever arm on the front side of the indicator, thereby giving a positive motion to the pencil. The drum cord of the indicator is led to a pulley, T, on drum shaft, K, the function of which is to bring the drum back to position after a line has been made. A sector and thumb screw regulate the length of the line and its position on the card.

The operation of the mechanism is as follows: The handle on the pencil shaft is raised, drawing the pencil about an eighth of an inch away from the paper, in which position it is held by a detent fixed on the armature of the magnet, L, engaging with a stop on the shaft. The handle, M, on the drum shaft is then raised, pulling the drum, against the tension of its string, around to the position of starting, where it is held by a detent engaging with the sector, N, on the right hand end of shaft.

The machine is now "set," and remains in this position until the mercury in the column rises to the point which is switched in and closes the circuit, when the armature of the magnet, L, with the detent attached to it, is drawn down, releasing the pencil shaft and allowing the pencil to come against the paper. When the pencil shaft is released the arm, O, on its lower side is drawn back by a spring, P, and strikes a floating bell crank lever, which in turn strikes the detent which holds the drum shaft and releases the shaft. The drum spring causes the drum to revolve, and a line about half an inch long is made on the card.

When the mercury in the column is descending, the machine is operated by breaking instead of closing the circuit. This is accomplished by means of the magnet, R, which is on circuit in the mercury, and the multiple switch. While the mercury covers the point that is switched in, the circuit is closed and the armature of the magnet is held down. As soon, however, as the mercury leaves the point, the armature is released and is drawn back by a spring against the contacts, which allows the circuit to then pass through the trip magnet, L, releasing the pencil shaft, the subsequent operations occurring as before. The whole operation is practically simultaneous.

An indicator test proceeds as follows: The indicator is carefully examined to see that the bearing surfaces of the cylinder and piston are clean, and that the motion is in adjustment and lubricated. With the indicator in a vertical position (without the spring), the motion is raised and allowed to fall by its own weight, first without and then with the piston, to insure that there is not excessive friction in the motion or between the piston and cylinder. With the piston at the bottom of the cylinder, the pencil is so adjusted that a ray of light can be seen between its point and the surface of the paper drum. The piston is then moved by blowing into the lower end of the cylinder, and the pencil is watched to see that its motion is parallel to the drum surface. With the pencil in the same position, the drum cylinder is pulled around to see that it is cylindrical and properly centered.

The spring is put into the indicator and the indicator is put on the manifold and connection made. In the meantime steam has been blown through the manifold to warm it up. Steam is admitted to the indicator until it has reached a working temperature, when the piston is moved rapidly up and down several times by opening and closing the indicator cock for the purpose of bringing the surfaces to a working condition.

When the indicator is all ready, the card is put on the drum. The metallic cards are used, as they permit the use of a brass point, with which a very fine and distinct line can be obtained.

The machine is set and the manifold is exhausted to about two and a half pounds below, and then opened to the atmosphere for the purpose of getting the zero line with the friction of the up motion on the instrument. The machine is tripped and the line is made. After again setting the machine, which operation throws the five pound point into circuit, steam is admitted to the manifold in sufficient quantity to cause the mercury to rise in the column at the rate of about five feet per minute. When it reaches the five pound point the machine is tripped automatically, and the up five pound line is made. The operation is continued in this way until the upper limit of the test is reached. The pressure is carried about five pounds higher, when the switches are arranged for down motion, and the valves adjusted to allow the pressure to decrease at about the same rate that it increased. As the mercury leaves each point the machine trips and a line is made. After passing the five pound point the manifold is opened to the atmosphere and the down zero line is made. The card is marked with the make and number of the instrument, whether it was tested as a right or left, the number and scale of the spring, the temperature of the mercury column, and the date of the test.

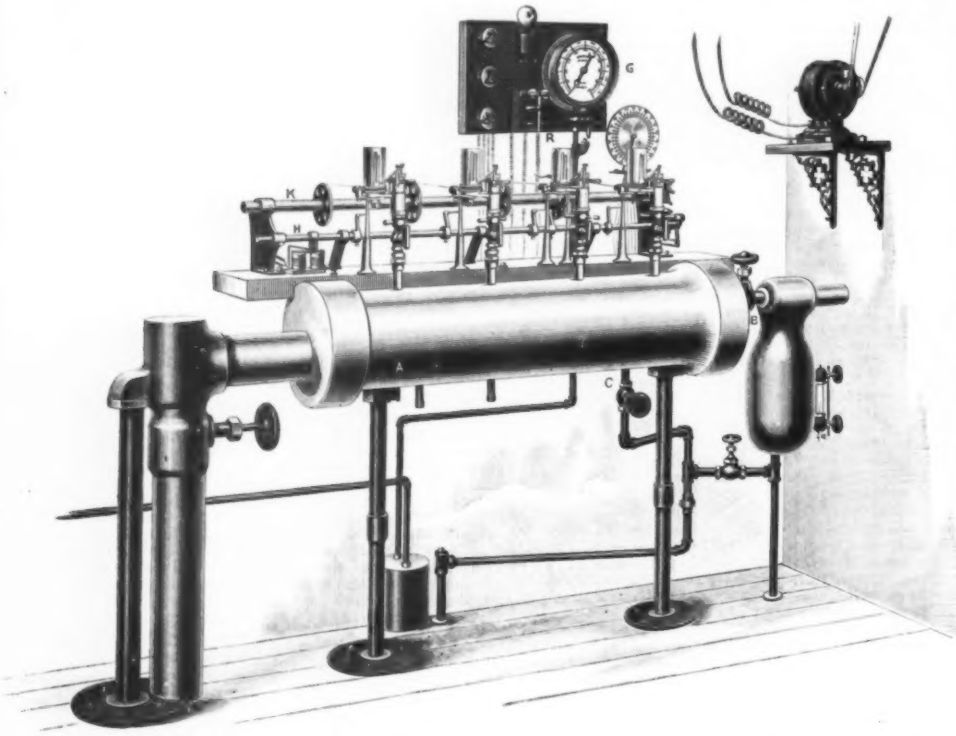


Fig. 1.—APPARATUS FOR TESTING INDICATOR SPRINGS, SHOWING FOUR INDICATORS UNDERGOING TEST.

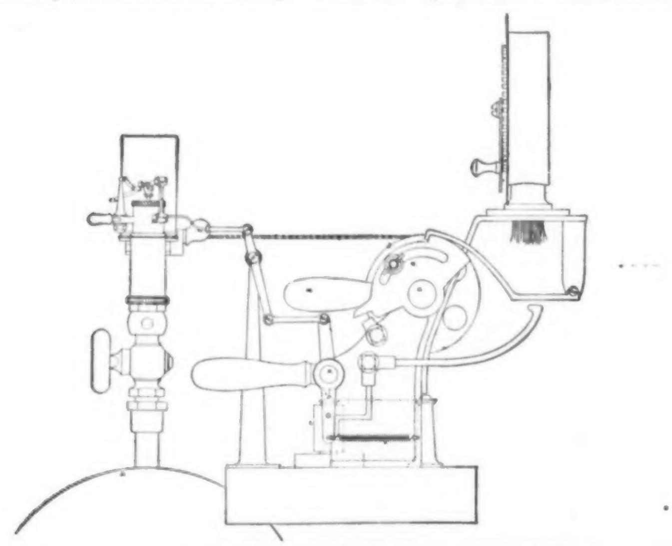


Fig. 2.—DIAGRAM SHOWING THE PARTS OF INDICATOR TESTING APPARATUS.

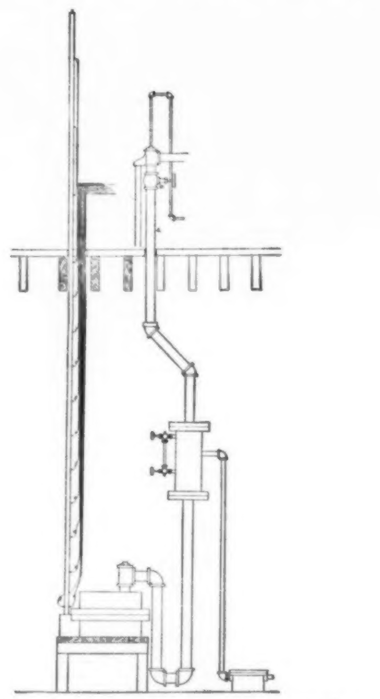


Fig. 3.—DIAGRAM OF THE MERCURY COLUMN AND ELECTRICAL CONTACTS FOR TESTING INDICATOR SPRINGS.

LOCOMOTIVE BUILDING IN JAPAN.

IT is now about four years since the first locomotive built in Japan was put upon the rails, and so far nine locomotives, representing the total output for the whole kingdom, have been turned out of the Kobe workshops of the imperial railways.

Of the above locomotives, four have started in work as recently as the last month or two, but the practical tests in the way of running to which all the others have been subjected have proved highly satisfactory. It is now claimed, and rightly so, that high class locomotives can be manufactured in Japan, and it is stated on good authority that the cost prices of such engines compare very favorably with those of the imported engines.

Trustworthy costs of any of the Japanese-built engines, with the exception of the first, are not forthcoming. The cost of the first engine showed an economy of $2,250 as compared with the price of foreign engines of a like quality and capacity when delivered on rails in Japan. But the price of engineering labor in Japan has gone up enormously during the last few years, and it is reasonable to suppose that on the more recent engines the cost price has been higher on this account; although one may assume that a certain saving may have been effected by the men having become more familiarized with this class of work.

More of these engines are being put in hand, and it is the intention of the government gradually to increase the number turned out in these works, and eventually to lay down a complete outfit of the necessary machinery for building locomotives on the most approved economical lines. Moreover, one or two independent companies are being organized in Japan for manufacturing locomotives.

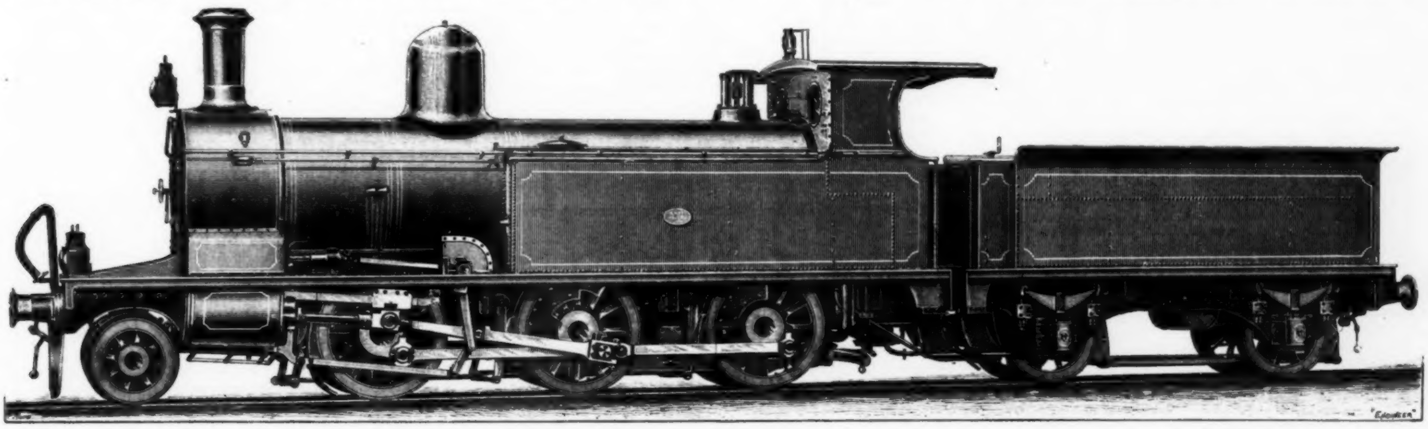
The accompanying engravings illustrate the most recent achievements in the way of locomotive building by the Japanese. They were built from the plans of Mr. Richard F. Trevithick, an Englishman, who is the locomotive superintendent of the Kobe workshops. It is interesting to note that this gentleman is the great-grandson of the famous Richard Trevithick, known as the "Father of the Locomotive."

Mr. Trevithick maintains that the use of the Joy valve motion on the Kobe-built freight engines has freed them from a cause of complaint frequently urged against all classes of heavy freight engines hitherto used on these railways, viz., the inaccessibility of the machinery between the frames; and he considers that this change involves no sacrifice of any good feature in their construction. The boiler center, being 6 ft. 5 in. above rail level—equivalent to 8 ft. $7\frac{1}{2}$ in. on the 4 ft. $8\frac{1}{2}$ in. gage—gives the engine a somewhat top-heavy appearance, and this, added to the lateral overhang of the side tanks, might suggest unsteady running. Such, however, is not the case, even at a speed of thirty miles per hour, and when rounding tolerably sharp curves. As regards brake power, the engines are well equipped, the coupled wheels and tender wheels being acted on by both automatic vacuum and hand brakes.

The frame plates, axles, tires, boiler tubes, plates, bars, angles, spring steel, and piping, iron and copper, were obtained from abroad, just as therein stated. The domes, dome seats, pressure gages, vacuum brake ejectors, vacuum brake cylinders, sight feed lubricators, and eight of the sixteen injectors were the only finished pieces from abroad used in the work. Owing to an insufficient supply of scrap iron, it was necessary to import a quantity of B. B. Staffordshire iron billets, but this in no way affected the work.

The following are the dimensions and details of the above six-coupled freight engines:

Diameter of cylinders	17 in.
Stroke of pistons	22 in.
Length of ports	13 in.
Width of steam ports	$1\frac{3}{8}$ in.
Width of exhaust ports	3 in.
Distance center to center of cylinders	5 ft. $5\frac{1}{8}$ in.
Inclination of cylinders	1 in 16.
Diameter of coupled wheels, with 3 in. thick tires	49 in.
Diameter of leading wheels, with 3 in. thick tires	31 in.
Height of boiler center above rail level	6 ft. 5 in.
177 tubes 12 B. W. G. thick:	
Outside diam. fire box end	$1\frac{3}{4}$ in.
Outside diam. smoke box end	$1\frac{15}{16}$ in.
Heating surface in tubes	887·65 sq. ft.
Heating surface in fire box	77·42 sq. ft.
Total	965·07 sq. ft.
Grate area	15·77 sq. ft.
Working pressure	145 lb. per sq. in.
Diameter of exhaust nozzle	$4\frac{3}{4}$ in.
Capacity of two side tanks	$607\frac{1}{8}$ gals.
Capacity of tender tank	$1212\frac{1}{2}$ gals.
Total quantity of water carried	1820 gals.
Coal usually put on tender	$1\frac{1}{8}$ tons.
Weight of engine with full side tanks	46 tons.
Weight of tender with full tank and $1\frac{1}{2}$ tons of coal on	18 tons.



NARROW GAGE, SIX-COUPLED FREIGHT ENGINE FOR THE IMPERIAL RAILWAYS OF JAPAN, BUILT AT THE KOBE GOVERNMENT WORKSHOPS.

Cylinders, 17 in. by 22 in; heating surface, 965 sq. ft.; steam pressure, 145 pounds per sq. in.

The four-coupled passenger engine is of a type of which four were built in 1895, and have been in service for periods varying from twelve to fourteen months, their aggregate mileage so far being over 187,000. All the imported four-coupled tender engines have so far been fitted with the link motion, and though in their case no complaints as to inaccessibility have been made, it is obvious that from a driver's point of view the Joy valve gear is the more convenient arrangement. Like the freight engines, the coupled wheels and tender wheels are acted on by the automatic vacuum and hand brakes.

The following are the dimensions and details of the above four-coupled passenger engines:

Diameter of cylinders	16 in.
Stroke of pistons	22 in.
Length of ports	13 in.
Width of steam ports	$1\frac{3}{8}$ in.
Width of exhaust ports	3 in.
Distance center to center of cylinders	5 ft. $2\frac{1}{8}$ in.
Inclination of cylinders	1 in 27.
Diameter of coupled wheels with 3 in. thick tires	55 in.
Diameter of bogie wheels with 3 in. thick tires	33 in.
Height of boiler center above rail level	6 ft. 3 in.
167 tubes 12 B. W. G. thick.	
Pitch of tubes $2\frac{3}{8}$ in.:	
Outside diam. fire box end	$1\frac{3}{4}$ in.
Outside diam. smoke box end	$1\frac{15}{16}$ in.
Heating surface in tubes	803·25 sq. ft.
Heating surface in fire box	71·75 sq. ft.
Total	875 sq. ft.
Grate area	13·87 sq. ft.
Working pressure	140 lb. per sq. in
Diameter of exhaust nozzle	$4\frac{1}{2}$ in.
Weight of engine loaded	42 tons.
Weight of tender loaded	24 tons.
Capacity of tender, coal	2 tons.
Capacity of tender, water	1710 gals.

RAILWAYS OF THE WORLD.

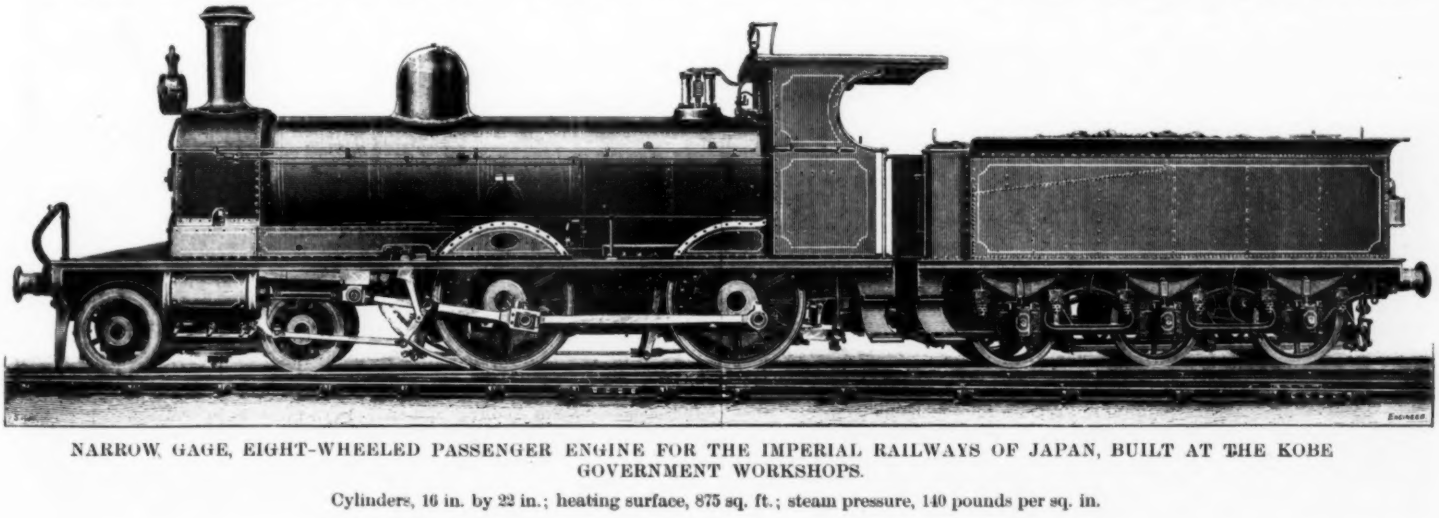
A REVIEW OF THE LAST SEVENTY-TWO YEARS.

SEVENTY-TWO years ago the first public steam railway, known as the Stockton and Darlington line, was formally opened in England—September 27, 1825. The world then saw the beginning of a most gigantic enterprise, one that has extended to every civilized and almost every uncivilized country on the globe and which now surpasses in magnitude any other single enterprise or industry.

Few persons, if asked, could answer the question as to how many miles of railway there are in the United States, and fewer still could make even a close guess as to the total length of railways now under operation in the entire world. According to the statistics compiled for 1896, the total length of the railway system of the whole world is 427,215 miles distributed over the various continents as follows: North America, 202,983; Europe, 152,417; Asia, 26,078; South America, 23,799; Australasia, 13,795; Africa, 8,143.

It is a noticeable fact that the railway mileage in the United States is greater than that of all Europe and Asia combined, the length of lines in this country in 1896 being 180,955 miles. There is no country in the world in which the effects of transportation are more evident than in the United States. Probably in the whole history of the human race there is no instance of the growth of a great and fully peopled empire so rapid as that of this country, and this growth has been due to its facilities for transportation. England, which was the country in which railways originated, has furnished the type for European railways, while the United States has distinctive railway features of its own. In England the railway was made to connect existing towns. In the United States the railroad preceded the town and passed through a country devoid of settled inhabitants.

The Stockton and Darlington was thirty-eight miles in length and the highest speed attained upon it was twenty miles an hour. Four years after the opening of that road the first line was opened for general traffic in the United States—the Mohawk and Hudson, sixteen miles, from Albany to Schenectady—August 9, 1829, and



NARROW GAGE, EIGHT-WHEELED PASSENGER ENGINE FOR THE IMPERIAL RAILWAYS OF JAPAN, BUILT AT THE KOBE GOVERNMENT WORKSHOPS.

Cylinders, 16 in. by 22 in.; heating surface, 875 sq. ft.; steam pressure, 140 pounds per sq. in.

forty years later, May 10, 1869, the connecting line between the Mississippi River and the Pacific coast was completed. After a steady progress of seventy-two years the total estimated value of the world's railways is $30,650,000,000. More than one-half of this vast sum is represented in the two great English speaking countries, $10,963,584,385 being the capital of the American railways and $5,005,000,000, the capital of the railways of Great Britain.

The contemplation of the vast system of railways in the United States is not a brain trying task for anyone brought up in this country and used to watch their development and extension. The long line of steel tracks are multiplied decade by decade, and to learn that the mileage has increased in a single year a thousand or two thousand miles is not startling. But in Asia and China and other parts of the Orient it is an entirely different matter. The customs, manners, and life of the people of the East to-day are the same as they were hundreds of years ago, and it has been necessary to overcome many difficulties and prejudices in order to construct such lines of railways as are now in operation there One can scarcely imagine the locomotive tearing across the country from Jaffa—Joppa of the Bible, and one of the oldest towns in the world—to Jerusalem, and it is hard to contemplate a railway station at Bagdad. But these are now realities, and before the close of the present century the great trans-Siberian railway—the longest on the globe—will be completed. This railway, which is a continuation of the trans-Caspian which runs from the Caspian Sea to Samarcand, 900 miles, will have a total length of 4,968 miles, is being rapidly pushed forward with an energy that does not lessen, considering the fact that at last report 70,000 men were at work upon it, the intention being to reach the Sea of Okhotsk in the north and Gold Horn Bay on the Sea of Japan in the south, thus completing with the Canadian Pacific, a band of railway round the world between the 30th and 40th degrees of latitude. The total length of line between St. Petersburg and Gold Horn Bay is 6,488 miles. One section of this road from Cheliabrisk to Omsk, 495 miles, was opened in 1894, the through fare being $5.40 first class and $2.70 fourth class. There is now an unbroken line of rail from St. Petersburg to Omsk, 2,128 miles, which is traveled by passenger train in about four days. The Asiatic boundary, marked by a granite obelisk, is reached in two days and four hours.

The Jaffa-Jerusalem railway was opened August 27, 1892, when the first train ran from the coast to the ancient Jewish capital. This road, which is fifty-three miles long, cost $2,000,000 to build, and the fare for a first class round trip is $4.

The completion of the railway line across Asiatic Turkey will give a continuous line from Scutari, opposite Constantinople, to Bagdad. Part of this line to Angora, 300 miles, is open, and when all is completed it will probably be possible to go from Paris to the Persian Gulf without change of cars. The through journey now made across the Continent to Constantinople, 1,858 miles, constitutes the longest journey on any of the European railways. This through train is known as the Orient express, and runs from Paris through Strasburg, Stuttgart, Munich, Vienna, Budapest, Belgrade, Nisch and Adrianople to Constantinople, thus passing through France, Germany, Austria-Hungary, Servia, Bulgaria and Turkey. The single fare is $90.

The first railway in India was opened in April, 1853, and the Hindoo railway system is now the most complete and best stocked of all the Asiatic systems. From Cape Comorin to the Vindhya Mountains, from Bombay to Madras, from Surat to Calcutta, India is covered with railways, the entire mileage of the country at the present time being 18,800 miles.

In Siam, practically the first railway is now under construction, in a line from Bangkok to Khorat, 163 miles. It is expected that the road will be ready toward the end of 1897, and although no hopes are held that it will pay as a commercial speculation, it is hoped that when the first engine steams into Khorat Siam will have made her best effort so far to escape from the state of semi-barbarism in which she is enthralled.

One hundred and-fifty miles is stated to be the length of the railways in China. This, however, is somewhat in excess of the actual number of miles in operation. The Chinese have not taken kindly to the steam railway in their own country, and but little effort has been put forward to establish a proper system of railway communication. Up to the year 1875 China had never possessed a single railway track. In June, 1876, the first line was laid along a strip of land nine miles in length, between Shanghai and Woosung, but in consequence of official jealousy and disagreement regarding it the rails were torn up in October, 1877, and thrown into the sea. It is said that plans are now being made to construct a railway between Canton and Koalang, 127 miles, which is to be the first section of a great railway to cross China from north to south, connecting Canton and Pekin. In Japan there are now 2,350 miles of railway in operation. The first line was opened there October 17, 1873, and steady progress has since been made in the construction of this means of transportation in that country.

The first railway in Egypt was opened June 26, 1856. About 1,400 miles of line are now operated. Between Alexandria and Cairo the railway track is almost perfectly level nearly the entire distance, which fact sometimes proves to be a great misfortune, as it is made the highway for droves of cattle, for camels and for human beings on foot, so that the speed of trains is often interrupted.

The railways of Persia extend the full length of six miles, being the line from Teheran to Shah-Abdul-Azim, which was opened in July, 1888. Another line from Mahmudabad on the Caspian to Barfurush and Amol, twenty miles, was commenced, but has not been completed.

Of the 13,795 miles of railway in Australasia, 3,119 are in Victoria, 2,531 in New South Wales, 2,379 in Queensland and 2,000 in New Zealand. The longest through journey on the Australian continent is from Jennings to Bourke, the most northerly railway town in New South Wales, 986 miles.

Canada has 136 railways, 25 of which have been amalgamated and form the Grand Trunk system. The consolidation of 22 others has produced the Canadian Pacific, which is to-day one of the greatest railway companies in the world. Through trains are run over this road from Montreal, on the St. Lawrence, to Vancouver, British Columbia, on the Pacific, a distance of 2,990 miles.

In the United States there are now in use 36,610 locomotives, of which 10,200 are passenger, 20,200 freight, 5,600 switching, and about 700 other locomotives not classified. There are 26,419 passenger cars, 1,230,798 freight cars and 7,891 baggage, mail and express cars; total, 1,265,108. The number of passengers carried last year was 543,974,263, or fewer by 40,000,000 than was carried the previous year. The average journey per passenger was 24·02 miles. The number of tons of freight carried was 763,799,883. The gross earnings of the railways in the United States (comprising 1,970 different companies) were $1,093,193,605, or nearly $3,000,000 per day! Of this sum $261,640,598 was received from passengers and $743,784,451 from freight.

The following figures show the number of passengers carried on the railways of the principal European countries in comparison with the United States: Great Britain, 864,000,000; Germany, 483,000,000; France, 305,000,000; Belgium, 87,000,000; Austria, 85,000,000; Hungary, 37,000,000; Italy, 51,000,000; Switzerland, 37,000,000; Netherlands, 33,000,000; Russia, 33,000,000; United States, 544,000,000.

The date of opening of the first railways in the various countries of Europe is as follows: Austria, September 20, 1828; France, October 1, 1828; Belgium, May 5, 1835; Germany, December 7, 1835; Russia, April 4, 1838; Holland, September 13, 1839; Italy, October 3, 1839; Switzerland, June 15, 1844; Denmark, September 18, 1844; Spain, October 3, 1848; Sweden, February 1, 1851; Norway, July 14, 1853; Portugal, July 9, 1854; Turkey and Roumania, October 4, 1860; Greece, February 18, 1869.

In 1892 the railways of the entire world carried 2,490,000,000 passengers and 1,502,000,000 tons of freight.—Brooklyn Eagle.

STREET AND OTHER RAILWAYS IN GREECE.

By NICHOLAS D. SOURMELY, in the Street Railway Journal.

As it is for the first time that this country, whose antique fame and glory are well known and cherished by every person of education throughout the civilized world, is brought through your valuable journal to the notice of your readers, and inasmuch as very little is known in the United States about its trade, industry, street and other railways, it will not be out of place, I think, to give here some particulars on these subjects.

The kingdom of Greece has now a population of over 2,500,000, and there are about 6,000,000 Greeks inhabiting the Turkish empire, Egypt and the Levant. The population of Greece is increasing rapidly by the continuous immigration of Greeks.

Athens, the capital of Greece, in whose center are to be found the grand monuments of her ancient glory and splendor, has close upon 150,000 inhabitants. It is the seat of the government, and carries on a large import business from all parts of the world, excepting the United States. Athens can justly boast of having the finest public buildings in the world, such as the National Academy, the National Library, the University, the National Polytechnic and museums, etc., all of them built and endowed by various Greek patriots. It is a noteworthy characteristic of this ancient race that whenever a Greek becomes rich he is sure to spend large sums of money in endowing his country with some institution or work of general utility. The family of Zappas have spent several millions for the erection of a magnificent marble building of adequate design and proportions, in which the Olympian games are held every four years.

The port of Athens is Piræus, a growing city of nearly 50,000 inhabitants, distant by rail about half an hour. The harbor accommodation is great, lighters are abundant, and every facility can be found for rapidly loading and unloading and coaling steamers at cheap rates. Most of the European steamship lines make regular calls at this port, and it has become a regular station for the naval squadrons in the Mediterranean waters of all the European powers. Piræus has become the center of the Greek industry and trade, and gradually but surely it is concentrating the transit trade of the Levant, becoming the most important distributing center for the Turkish empire, Egypt, etc. Piræus possesses the finest flour mills, cotton mills, woolen mills, engineering works, shipbuilding yards, etc., in the Levant, giving permanent work to several thousands of workmen, the government of the country granting every possible facility, exemptions, etc., for their development and welfare. Other towns of importance are Patras, Volo, Syra, Kalamata, Corfu, etc.

The province of Thessaly is playing a most important part in the import trade, as it produces large quantities of wheat, corn, etc.

For about nine years now Greece has suffered from a serious financial crisis, brought about by the heavy expenditure on public works, etc., the various governments borrowing heavily and at comparatively high rates of interest. The national debt of Greece may be stated to be about $120,000,000. The large amount of paper currency issued caused gold and silver to rise at a terrific rate, with serious consequences to the nation generally, the import trade suffering most severely. The credit of the country received a severe but unjust blow by the temporary suspension of the payment of the interest on the national debt, pending the negotiations for the reduction of the same to a reasonable rate. To this the German bondholders brought the greatest obstacle to an amicable and satisfactory arrangement.

This crisis caused several capitalists in Greece to invest heavily in manufacturing and other concerns with marked success. Labor is extremely cheap, the average price of the best Cardiff coal is about $4 per ton of 2,240 lb., and the government wisely helps manufacturers by raising the import dues, and by allowing raw materials to be imported free of duty. By such means and encouragement, there are now established, working full time and yielding handsome profits, a good number of industrial establishments all over the country.

The United States ambassador in Athens is the Hon. Eben Alexander, the very best and cleverest diplomat the United States have ever sent out here. I say the very best and most suitable, because to his personal influence and tact is due the feeling of sympathy created here for his country; and if at the present time there has sprung up a demand for American goods, it is due exclusively to him. As it may easily be conceived, it is far from easy for the Greek importers who have business relations of long standing with British and Belgian manufacturers to make a trial of American goods and "notions." The distance between the two countries is so great, the means and cost of communication so difficult, the terms and conditions of American firms so different from those granted by "John Bull," that it must be a matter of congratulation and pride to Mr. Alexander that he has succeeded in the successful importation of his country's products into Greece. A good start has been made. Follow it up closely, and success is certain to result. American goods can be offered at cheaper prices, and their quality will favorably compare with that of even German goods. One thing is wanted to secure for American goods a permanent and profitable footing in these important markets—a regular monthly steamship line plying between New York, via Liverpool, to Piræus, at cheap rates.

From a political point of view, Greece, during the last few months, has been in a fever of enthusiasm on the annexation of the great and beautiful island of Crete. This island has about 300,000 inhabitants, nine-tenths of whom are Greeks. The island is extremely fertile and yields various agricultural and other products to a yearly value exceeding $10,000,000, and this will be doubled as soon as peace and quiet allow the inhabitants to cultivate their lands. Your readers will doubtless have read that recently the united European fleets bombarded the Christian camp outside the port of Canea and killed many persons. The correspondent of the London Daily News wired to his paper that the sight was horrible, and add to this that the Turks were allowed to fire on the Christians at the same time! The Greek flag was struck down twice, and twice it was raised in defiance by the Greeks, who kept their stand during all the time the fleets bombarded them. The European nations have been moved, the indignation of the people of England, France and Italy has been aroused. The vote of sympathy of the United States Congress and Senate was very much appreciated in this country.

Coming now to the question of street and other railways, I have to say that there is a good field for American contractors, locomotive and rolling stock builders and others to transact much business in Greece. At the present moment the following lines are in the market: The municipality of Patras, a town of nearly 50,000 inhabitants, wants to build a tramway of a total length of about 18 miles, horse, steam or electric traction.

Another line proposed is that from Athens to Vouliagmeni, a length of about 14 miles.

Another line is from Calamata to the seaside, a length of about 4 miles; all good paying little contracts. The government lends valuable help for such work by granting exceptional concessions, such as freedom from all import and all other dues, and every other possible facility. There is one important consideration to be held in view for such works out here—labor is abundant and extremely cheap; for example, the usual railroad diggers and workmen are paid on an average fifty to sixty cents per working day of eleven hours; engine drivers, seventy cents to one dollar; engineers, draughtsmen, etc., a little over one dollar. The internal cost of transportation is cheap, and, in fact, we have so many facilities that it is really a pleasure to undertake such contracts in Greece.

Athens has a Belgian Greek Tramways Company, with extensions to New and Old Phalerum (the summer resort of Athens). Within the city and the suburbs the tramways use horse traction. To Phalerum and Piræus they use locomotives of Krusse & Company, of Leipzig. Their nominal capital is 2,200,000 fr., divided in shares of 500 fr. each. The chief offices are at Brussels and the official title is the "Cie. des Tramways d'Athènes et Extensions." Its franchise gives this company the right to build and work 42 kilometers of line (30 inch gage), but they have constructed and are actually working lines about 30 kilometers in all.

At Piræus we have a tram line from the railway station to the custom house, a short distance of less than a mile, worked and owned by the Athens-Piræus Railway Company.

The Piræus Athens Railway (length 10 kilometers) is justly considered the best paying line in Greece. The locomotives in use are of English and Belgian make. The chief engineer is an Englishman, Mr. Simmons, a clever railway engineer who served for many years in the famous Cornwall works of Tangyes, Limited, Birmingham, and other eminent British builders. Other important roads are the Piræus-Athens-Peloponnesus Railway, the Thessalian Railway, the Attica Railway, the Northeastern Railway and the Pyrgos-Katakolos Railway. With the exception of the Athens-Piræus Railway, which uses English locomotives and rolling stock, all the railway companies employ locomotives of French, German or Belgian make.

The new asbestos fireproof paper is used in Germany. It is the invention of Herr L. Frobeem of Berlin. It consists of 95 parts of asbestos fiber. It is washed with a solution of calcium permanganate, and is then treated with sulphuric acid, the fiber being thus bleached. After treating the fiber in this way, five parts of the wood pulp finely ground are added and the whole mass is placed in an agitating box with the addition of borax or lime water. After being thoroughly mixed, the material is dumped into a settling box and allowed to flow out of a cut into an endless wire cloth. From this wire cloth it is taken up into the usual paper making machinery. It is said that the paper produced in this way will resist the direct influence of flame and may be placed in a white heat without destroying it.

One of the most interesting narrow gage railways in the world is from Siliguni to Darjeeling in India. Though this line is but fifty-one miles long, it climbs more than 7,000 feet in this distance. The gage is two feet, and the engines weighing twelve tons each are capable of drawing the load of thirty-nine tons inclusive of their own weight at an incline of one in twenty-five. The cost of the road was $17,500 per mile and it is said that a dividend of ten per cent. yearly is paid.

COLLODIO-CHLORIDE EMULSION FOR TRANSPARENCIES.

FROM the very earliest days of the collodio-chloride process it has been the custom to speak of it as an admirable method of making transparencies, and yet how seldom do we see any results produced in this manner. The ordinary print-out emulsion is now referred to, as, if an emulsion for development be required, one of silver bromide is infinitely to be preferred.

The reason why collodio-chloride transparencies are so seldom met with is, no doubt, to be found in the fact that the emulsion as usually compounded is anything but suited to use on glass or to the formation of a smooth, structureless film when viewed by transmitted light. In the first place, the large amount of crystalline matter it contains is against its drying evenly on the non-absorptive glass surface, or, if it be dried with a semblance of evenness, retaining that evenness for very long, owing to the tendency of the different salts it contains, some to crystallize, some to deliquesce, and all to interfere materially with the smoothness of the film. Add to this that the excess of acid, sometimes unnecessarily large, used for the double purpose of giving vigor to the image and keeping qualities to the emulsion, exercises a specially injurious action on the collodion, rendering it thick and viscid, with a tendency to flow in ridges, and to dry in much the same state in two painfully visible crapy lines.

Another point that may perhaps have some bearing on the matter, though it does not directly affect the quality of result, is the character of the chloride used in making the emulsion. On account of their easy solubility in alcohol, and for other reasons, certain chlorides, such as those of calcium, barium and zinc, are often used, and these, although they may not at once confer any bad qualities on the emulsion, will sooner or later cause it to clot together and lose its fluency and eventually become solid. Unless, therefore, a quantity of emulsion is to be used up at once, the greater part of it becomes useless, which is naturally not a recommendation in favor of the process.

In making an emulsion, therefore, specially for transparency purposes, we should endeavor to steer clear of these difficulties, and, in fact, in every way work in the direction of a preparation that will adapt itself to the exigencies of glass. But perhaps the first point to be considered is the pyroxyline, for without a suitable sample of this all further efforts are without avail. The best sort for collodio-chloride is a very soluble sample, and such being obtained, the first step should be to ascertain how large a quantity can safely be used without causing a crapy and unsightly film. One great fault is that too small a quantity of cotton is too often used, which, though it gives a smooth and easy-flowing emulsion, and one quite suitable for paper, is too thin both to hold the salts without crystallizing and to give the density necessary in a transparency. Therefore ascertain, first of all, the maximum quantity of cotton the collodion will bear. This should, with a good soluble sample, be not less than nine or ten grains to the ounce.

The following formula is one that has given very good results, both on glass and on paper, flows and dries well, and keeps for some months without becoming thick:

Pyroxyline	100 to 120 grains.
Ether, methylated (0·720)	5 ounces.
Absolute alcohol	5 "
Chloride of sodium	15 grains.
Citric acid	20 "
Nitrate of silver	90 "

Dissolve the cotton in the ether and three ounces of alcohol, reserving two ounces of the latter for the solution of the salts. When the cotton is dissolved, add the citric acid in crystals, or it may be dissolved before making the collodion in the three ounces of alcohol. When dissolved, the silver may be added. This is first dissolved in about forty minims of water by boiling in a test tube, and one ounce of alcohol gradually added, warming it to prevent precipitation of the silver. Pour this a little at a time into the collodion, and shake well after each addition; this will produce a white, milky emulsion, partly from formation of citrate of silver and partly from precipitation of the nitrate in minute crystals. Next dissolve the chloride of sodium in the same quantity of water, carefully washing out the test tube first, and add the remaining ounce of alcohol; pour in in the same manner as the silver, and shake vigorously for two or three minutes, and afterward at intervals. In an hour's time the emulsion may be filtered through a piece of clean calico or linen, and is ready for use, but it will be better in a few hours' time.

Chloride of lithium, in the proportion of ten grains instead of fifteen, may be used instead of the sodium salt, though the latter is to be preferred if absolute alcohol and 0·720 ether can be obtained. If not, the lithium salt, being easily soluble without the aid of water, saves the addition of the second forty minims, and thus improves the flowing qualities of the preparation. If the image prints too red in color, two or three drops of strong ammonia may be added, and thoroughly well shaken.

Collodio-chloride on glass is very difficult to work without a substratum, owing to its strong tendency to peel off. The substratum may consist of a plain solution of gelatine, three grains to the ounce, poured on to the glass warm, drained and allowed to dry in a place free from dust. In addition to causing the film to adhere firmly during washing, toning, and fixing, the substratum also helps, by absorbing the crystalline matter, to prevent crystallization and unevenness in drying.

Glass plates should, however, never be prepared beforehand, as, owing to the hygroscopic nature of the matter contained in the film, it is impossible to avoid deliquescence and crystallization unless they be hermetically sealed. It is an easy matter, however, to coat the glass at the time of use, and if dried by heat and the negative also warmed, no trouble need be feared from any of the causes of unevenness. The transparencies should be toned and fixed as soon as possible after printing. Any of the usual toning baths will answer, acetate, phosphate, or tungstate giving the best results.—W. B. Bolton in The British Journal of Photography.

THE USE OF GUTTA PERCHA IN THE UNITED STATES.

By JOHN M. ARMSTRONG.

IT is not a pleasant thing to say, perhaps, but the manufacturers of the United States show a dullness and apathy in certain lines that is in marvelous contrast to their progressiveness in others. For example, if one wishes to get articles manufactured of gutta percha, it is next to impossible to get any one to even attempt the work unless it be in staple lines. On the other hand, if anything is to be made of India rubber, no matter how insignificant, there are scores of bidders for the work. India rubber has completely eclipsed gutta percha in America, and it is a pity that it is so, for there are many places in which gutta would fit far better than rubber. The progressive rubber manufacturers to-day are looking for new gums for friction, for packing, for special work, and examine anything new in rubber with the deepest interest. If, however, an importer brings in a ten cent low grade gutta and ask that it be tried, even if he can point out a place where it is needed, and tell how to manipulate it, the manufacturer, nine times out of ten, will refuse to touch it. Not only is this distaste toward experimenting with gutta very general to-day, but it is on the increase, and that, too, in the face of the fact that in Europe the business is growing, and every new grade of the gum finds some good use. For instance, a six cent gutta, an inferior article, of course, was rejected with contempt by the American manufacturer as utterly worthless. An English firm, however, took it up, and made of it a paint for ships' bottoms, to which no barnacle can be tempted to attach itself, and as a result have made a handsome fortune.

Twenty years ago it was not an unusual thing for an order for fifty tons of gutta to be placed by a single firm. To-day such an order would be looked upon as a great curiosity. Nor is this falling off due to the scarcity of the gum. Orders can be filled in spite of the constant talk about the growing scarcity of the article.

Gutta percha in the United States is used chiefly for the insulation of cables, in the making of cements, in pattern work, in linings for soda fountains and acid tanks, in golf balls, and in the manufacture of tissue. In spite of this, more manufactured gutta is imported than is here made. Here gutta percha tissue is costly. In Europe it is so common and so cheap that every tiny bunch of flowers for the buttonhole has the stem wrapped in it to keep them from wilting.

In keeping with the indifference of the rubber manufacturer regarding this wonderful gum is the ignorance of the general public concerning it. The vast majority believe it to be the same as India rubber, while the semi-intelligent few confuse it with vulcanite. For this and other reasons it seems to me that an occasional résumé of the history of gutta percha should be a part of the educational plan of the India Rubber World.

The gutta percha of to-day is produced chiefly from the tree known as the Dichopsis gutta. This tree is of great size, being from four to five feet in diameter and between 100 or more feet in height. It has a clean, straight stem, the flowers are small, white, and divided into six petals and six sepals. The seeds, generally two in each fruit, are early eaten by birds and monkeys. The method of collecting gutta has been many times described and does not vary particularly from year to year, although, through the efforts of the conservators of forests, the trees are now being carefully tapped instead of being felled as heretofore. The gutta as first collected is white, but soon becomes pink and finally brownish red. A fact with regard to crude gutta percha that is not generally understood is that there are many varieties of it. For instance, in the Straits Settlements are to be found six kinds of Dichopsis which produce a marketable article, no two qualities being alike. Further than that, nearly a hundred species of gutta producing trees have been located and described by botanists, most of which are to-day tapped for the gum.

It is of interest, now that we are fairly launched into a consideration of this subject, to go back a few years and learn what the past of the gum has been.

Gutta percha, like many other of the most valuable substances and agents in nature, was discovered by accident. The merit of the discovery is due to Dr. W. Montgomerie, of England. He received, in 1845, the gold medal of the Society of Arts, in London, for his valuable service in introducing it to the British public.

As far back as 1822, when on duty at Singapore as assistant surgeon to the residency, he accidentally heard the name of the substance, and was led to make some inquiries concerning it, but it was not till 1842 that he met with any success. While at Singapore he observed on one occasion, in the hands of a Malayan woodsman, the handle of a parang made of a material quite new to him, and which appeared to be very different from caoutchouc, to which his attention had hitherto been mainly directed. On inquiry he found that it was made of a substance which the natives called gutta percha. Having subjected it to experiment, he speedily discovered many of its valuable properties; and at once concluded that if procurable in large quantities it would become extensively useful, and would in a great degree supplant the use of caoutchouc. The conclusion induced him to forward specimens of the gutta percha to the Asiatic Society of Bengal and to the Society of Arts in London.

When Dr. Montgomerie made his inquiries in 1842, this substance was quite unknown to the people at Malacca and Sumatra. The gutta percha tree grows abundantly in the island of Singapore and in the dense forests at the extremity of the Malayan Peninsula; also in Sarawak, and all over the island of Borneo. The tree is one of the largest found in these forests, and while its wood is seldom used, an oil is procurable from the fruit, which the natives use with their food.

Gutta percha was first introduced into England for purposes of manufacture by Richard Archibald Brooman, of London. To him letters patent were granted for some of its applications in 1844 and 1845. Others were granted as follows: In May 20, 1845, to Christopher Nickles, for its application to bookbinding, etc.; May 29, 1845, to Charles Keene, of London, for its application to boots, shoes, hats and all articles of wearing apparel; September 4, 1846, to a Quaker of Dublin, of the name of Bewley, for its application to the manufacture of flexible syringes, tubes, bottles, hose and articles of a similar description. Three, dated January 12, 1846, May 15, 1846, and February 15, 1847, were granted to Charles Hancock, of London, for the manufacture of machine bands, cords, etc.

For the first two years (1845 and 1847) after the introduction of gutta percha as an article of commerce and manufacture, it was confined to England. This will occasion no surprise, when we consider the shrewdness, the energy and enterprise with which the article was managed by the English patentees. As soon as it was discovered that gutta percha had any value for manufacturing purposes, the Dublin Quaker and others purchased all the patents in England, formed a gigantic company, enlisting in it many members of the East India Company, and at once commenced the manufacture of gutta percha in all its branches. This company immediately applied for letters patent in France, Germany and the United States. So that scarce had the name of the article reached the public ear before a vast monopoly, with one of the richest banking houses in England at its head, was formed. This rapidity of movement and abundance of capital were necessary to secure the end the company had in view, namely, to monopolize not only the manufacture of gutta percha, but also the raw material. For this purpose they established their agencies at Singapore, and, in connection with the East India Company, planted them along the entire length of the Malayan coast. All this was accomplished ere a word reached this side of the Atlantic. To this statement there is one exception; for as early as May, 1846, William S. Wetmore, Esq., an eminent merchant of the city of New York, received from one of his agents at Singapore a few bundles of whips made by the natives of that country. Always distinguished for sagacity and enterprise in his business movements, this gentleman became at once exceedingly anxious to know more of this substance. Himself a pioneer of the island of Borneo, and well acquainted with the resources of that and the neighboring islands, he immediately ordered his agents to purchase the raw material and ship it to the United States.

In the summer of 1846, Samuel T. Armstrong, of New York City, well known for his numerous and important contributions to the useful arts, received from one of the directors of the East India Company specimens of gutta percha, in its crude and manufactured state, with an invitation to visit London for the purpose of effecting some arrangement with that company, by which that article might be introduced into the United States. Owing to engagements entered into with the American government, Mr. Armstrong could not leave for London till the month of March, 1847. He arrived in England about the first of April, visited all the gutta percha manufactories there and on the Continent, and finally made arrangements for the purchase of the patents granted by, or to be granted by, the United States to Brooman, Hancock, Bewley, Keene and Nickles. He also effected an arrangement with the monopoly in London for a supply of the raw material, knowing that without such an arrangement it would be impossible to undertake the manufacture of gutta percha in this country. Mr. Armstrong returned to the United States in the fall of 1847, and immediately applied himself to the construction of the necessary machinery. This being accomplished, he at once began the manufacture of gutta percha in all its most important branches. The first intimation which reached the public of this was the announcement of the arrival of an invoice of gutta percha from London, consigned to S. T. Armstrong. From these facts it will be seen that Mr. Armstrong was the earliest importer of gutta percha, as an article of commerce and manufacture, into the port of New York, and the first manufacturer of the article in the United States. The first gutta percha belt used in this country on machinery was sold by Mr. Armstrong to Messrs. Corning, Horner & Company to be used on machinery run by them at Sing Sing, N. Y.

A curious fact about the early use of the gum was that by many it was believed to have a far more brilliant future than India rubber.

In the manufacture of vulcanized India rubber at that time under the Goodyear patents, there were those who honestly believed that gutta percha was destined to drive out rubber. It was a matter of belief that from gutta percha could be produced all of the goods that to-day are produced from India rubber. In a pamphlet issued by a gutta percha company in the early fifties, the following comparisons between crude India rubber and crude gutta percha are instituted, and, as they serve to show the radical difference between the two gums, they are worth quoting:

"India rubber is of a soft gummy nature, not very tenacious, astonishingly elastic."

"Gutta percha is fibrous, extremely tenacious, and without elasticity or much flexibility."

"India rubber once reduced to a liquid state by heat appears like tar and is unfit for further use."

"Gutta percha may be melted and cooled any number of times without injury for future manufacture."

"India rubber coming in contact with oily or fatty substances is soon decomposed and ruined."

"Gutta percha is not decomposed by coming in contact with oily or fatty substances."

"India rubber is ruined by coming in contact with sulphuric, muriatic and other acids." [?]

"Gutta percha resists the action of these and nearly all acids."

"India rubber is a conductor of heat, cold and electricity." [Evidently an error.—ED.]

"Gutta percha is a non-conductor of heat, cold and electricity."

"India rubber exposed to the action of boiling water increases in bulk, does not lose its elasticity and cannot be moulded."

"Gutta percha exposed to the action of boiling water contracts, becomes soft like dough, may be moulded into any shape, which will be retained when cool."

"India rubber is not a perfect repellant of water, but is more or less absorbent according to quality."

"Gutta percha has an oily property and is a perfect repellant of liquids."

It is important for the reader to understand that the writer was talking about crude or unvulcanized India rubber and crude gutta percha. The success that the Goodyear patents attained in doing away with almost all of the disabilities of crude India rubber led inventors to attempt to remove the very plain disabilities that gutta percha possessed. Among the first to claim to have succeeded in producing vulcanized gutta percha

was Charles Hancock, of England, while in this country were granted what were known as the Rider and Murphy patents for the vulcanization of gutta percha. The first of those granted in 1852 to William E. Rider described the preparation of the gutta percha for vulcanization as follows: First heat the gum to 285° to 430° F. to expel all volatile gases. Then incorporate a hyposulphite either with or without metallic sulphurets, or with or without whiting or magnesia. Then subject to temperature from 285° to 320° F. The second patent granted to William E. Rider and John Murphy in the year following covered a process for subjecting the gutta percha goods to hydrogen gas to remove the bloom.

There is no doubt but what the goods produced by this firm had many characteristics that we do not expect to find to-day in manufactured gutta percha, and were the gum more abundant and cheaper than India rubber, some such processes would be doubtless used. It is also within the limits of probability that our mackintosh fabrics and many other goods would have gutta percha for water repellant instead of India rubber. It is a matter of record that fabrics were produced that were very similar to vulcanized rubber, would stand a high degree of heat, and that never decomposed nor grew tacky.

While the Americans were claiming to vulcanize gutta by one process, the English were at work on another, for, in 1846, Charles Hancock was granted a patent for combining gutta percha with sulphur or sulphurets and treating it for a long time under a high pressure of steam. He also describes the manufacture of porous gutta percha by mixing it with alum, carbonate of ammonia, or some such substance that volatilized easily, and subjecting it to heat. In a patent granted to him in May of the same year, he steeps gutta percha in an alkaline solution, thereby diminishing its acidity and removing its smell. In a patent granted in February of the year following, he really claims the vulcanization of gutta percha by a combination of sulphur and sulphurets. The proportions that he advises are 48 parts of gutta percha, 6 parts of sulphuret of antimony or hydrosulphuret of lime or some analogous sulphuret, and one part of sulphur. The compound is boiled under pressure.

All this is of course interesting and shows the experimental work done by the early pioneers in India rubber to develop gutta percha. To-day no one expects this gum to take the place of rubber. As a vulcanized gum it is not a success, but for acid work, for insulation under water, and for a thousand and one special uses it is needed, and every manufacturer of mechanical rubber goods, of druggists' and surgical specialties, or of insulators, should be perfectly familiar with it.—J. M. Armstrong, in India Rubber World.

Italy broke its record of emigration in 1896, the number of persons leaving the country being 306,093, three fifths of the number intending to stay away permanently. Sixty-eight thousand persons came to the United States, 75,024 went to Argentina, the others went chiefly to Uruguay and Brazil. For the first time the number of Italian emigrants exceeds that sent out by any other European country during the year.

MACHINE FOR DEGREASING LEATHER.

THE use of dyed leather is familiar to every one. It is seen in purses, cigar cases, the linings of hats, in gloves, and in hundreds of other instances. The skins most generally employed for such purposes are sheep skins (skivers and basils), calf, goat, chamois, and white leathers. They are tanned with sumac or with bark, according to their nature, but whatever the agent employed, the natural grease existing in the skin is not wholly removed in the process. The grease resists the introduction of the dye, and not only does it render the skin less capable of absorbing the coloring matter, but owing to its unequal distribution, it causes the dye to act irregularly, producing a mottled effect, which is quite inadmissible in high class goods dyed in light colors. To remove the grease the skins need to be treated with benzine, which, by its well known solvent action, leaves them in a state in which the dye can penetrate them perfectly. It is possible to carry out this degreasing treatment by the crude method of soaking and drying in the open, but the cost of the spirit and the danger of the process have long since caused this plan to be abandoned. The ordinary practice is now to skewer the skins in batches on frames, and hang them in closed vats, where they are subjected to a constant shower of benzine. When the grease is believed to be entirely removed, the benzine is stopped, and hot air forced through the vats to evaporate the spirit still remaining in the skins. This part of the process needs to be conducted with great caution, as a slight excess of temperature has a very detrimental effect on the leather.

Recently a new machine for degreasing leather has been invented by Messrs. Wright & Monk, Parkinson Street, Nottingham. This machine we illustrate on the present and opposite pages in this issue. It has been designed to avoid the defects of the existing process by obtaining a perfect distribution of benzine over every part of each individual skin, and by conducting the drying process at a much lower temperature than heretofore. As will be gathered from the description we give, very great pains have been taken to insure the success of the various operations, and to render the apparatus as nearly as possible automatic, the only manual operations being those connected with fixing the skins in the frames and subsequently removing them.

The apparatus is contained in a building 42 ft. by 34 ft., and 32 ft. high, and provided with a 6 ton traveling crane for erecting the plant and executing repairs. The operation is carried out on the second floor, 19 ft. from the basement, from which the various parts of the machine are manipulated. The upper parts of the machine are carried upon four main girders, running from side to side of the building, and supported also by eight cast iron columns from below. The two tanks in which the skins are degreased are 14 ft. by 7 ft. and 6 ft. 6 in. deep, and are so arranged that while 36 dozen skins are being degreased in one tank, another lot are being dried in the second tank. The tops of the tanks are of cast iron fitted with suitable lids for closing the tanks while the goods are being operated upon. Each lid, together with the iron frames supporting the gratings, is lifted from above by a convenient arrangement of gearing (Fig. 2), consisting of chains passing over two chain wheels having a balance weight attached to the end of the chains, actuated by a spur wheel and pinion, upon the axis of which is fixed a hand chain wheel for working the lifting gear intended for raising and lowering the lid. On the underside of each lid are three sets of gratings, each carried by four connecting links, and from these gratings the skins to be treated are suspended by spring clips. Each grating accommodates 12 dozen skins, which are hung vertically face to face, with a space of ½ in. between each pair of adjacent faces. There are three clips to each skin, the center one being fixed and the other two movable, and capable of being instantly adjusted to suit any width of skin. As soon as a skin is put into position, and the clips released, the suspended skin is held stretched between the outer clips, by means of two compressed springs, fixed on the wire, carrying the clips for each skin. The advantage of this means of suspension, as opposed to the older system of skewering, is apparent on account of the more efficient circulation both of air and spirit among the skins, apart from the mechanical damage done to the goods by the method of skewering.

When the lid has been lowered, together with the skins, into the degreasing chamber, the latter is at once made airtight by a special arrangement of fastenings. A reciprocating motion is imparted to the frames, and the skins are thereby kept in constant motion in the solvent, aiding its action, and preventing any chance contact between adjacent skins from shielding them from the action of the fluid. This agitation, combined with a constant and vigorous circulation of compressed air, is a most important feature in obtaining uniform degreasing.

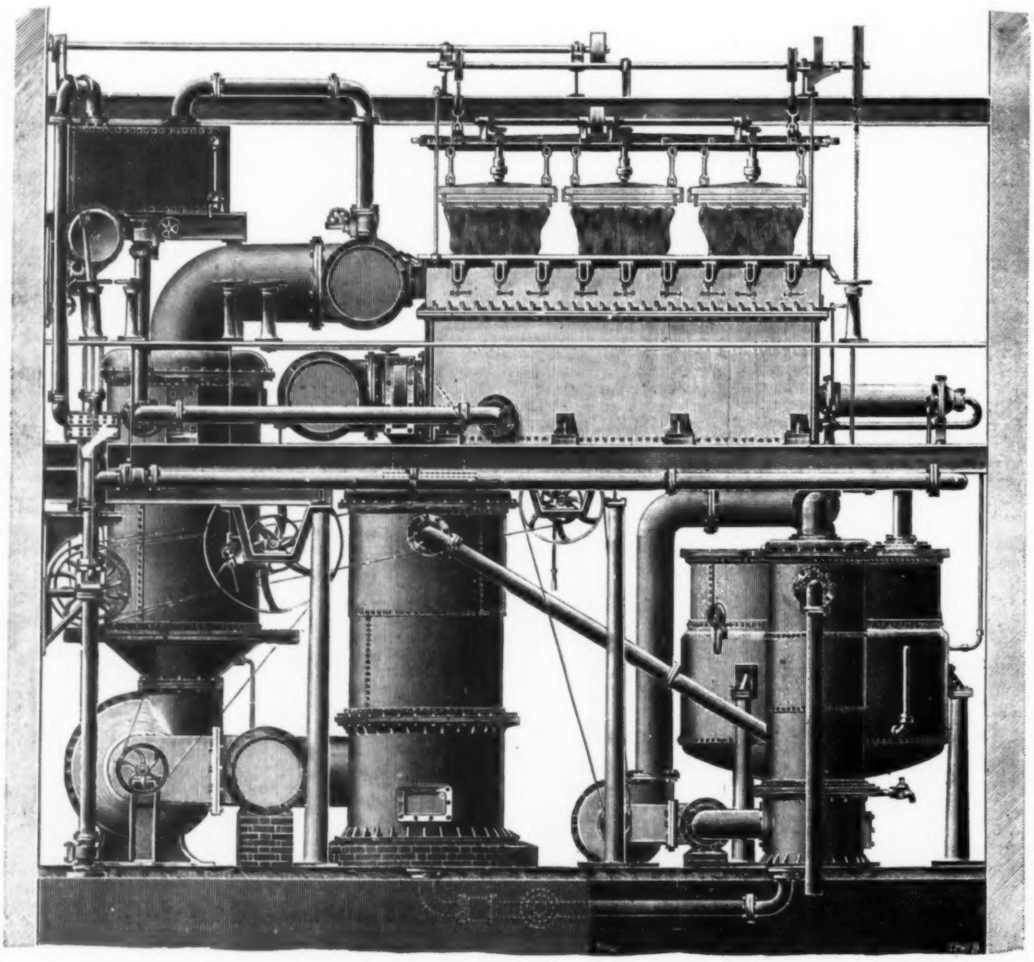


FIG. 1.—MACHINERY FOR DEGREASING LEATHER.

The degreasing tanks are connected by suitable pipes and valves to a charging tank, to which solvent is supplied from a store tank in the basement by a double-acting vertical pump having cylinders 8 in. in diameter by 18 in. stroke, and a plunger speed of 70 ft. per minute. When the necessary charge of solvent has been admitted to the degreasing chamber, the oscillation of the frames is started, and also a horizontal air compressor with cylinder 8 in. in diameter by 12 in. stroke. This pump takes air from the upper part of the tank and forces it through an air heater, which raises the air to a suitable temperature. It is then delivered through a series of perforated pipes at the bottom of the tank, thus keeping the solvent at a uniform temperature, and in a constant state of agitation, so that the specific gravity of the liquid is the same in every part of the tank, and the quantity of fat extracted is distributed and diffuses itself throughout the entire volume of the solvent.

When the degreasing operation is completed, the movement of the frames and the air compressor is stopped. A suitable time is then allowed for any solid matter, such as sumac, etc., to settle, after which a portion of the solvent is taken back to the charge tank, and the remaining quantity is run into an evaporator 9 ft. in diameter and 8 ft. deep, with 1,500 gallons capacity. This evaporator is steam jacketed and fitted with a steam coil inside, and is also provided with a set of water gages and a special arrangement of thermometers, to ascertain the temperature at any time during

the process of evaporation. The vapor from the evaporator is conveyed to two vertical tubular condensers, 3 ft. 4 in. in diameter by 8 ft. long, fitted with suitable copper tubes, which are tinned inside and capable of recovering 500 gallons of solvent per hour each. The base vessel of these condensers and the pipes conveying the recovered solvent, together with the store tanks, are all galvanized throughout, so as to avoid any iron oxide collecting in the store tanks, which would be objectionable and cause iron stains on the goods. By the base vessel of these condensers is fixed a 30 in. circulating fan, which assists the vapor in passing through the condensers and delivers it into the evaporator, and so again back to the condensers. This arrangement of separate condensers for recovering the solvent enables this part of the process to be carried on independently of the drying operation.

When the whole of the benzine has been run from the degreasing vat, and the goods are ready to be dried, two 1 ft. 9 in. sluice valves are opened to connect the chamber in which the goods are placed with another special vertical tubular condenser. To this is connected a 60 in. circulating fan running 800 revolutions per minute, and discharging approximately 12,000 cubic feet of air per minute through a vertical tubular heater of 267 2 in. tubes, giving a combined area of 838 square inches. This heater is connected by a 2 ft. 6 in. pipe, having a rectangular branch of 720 square inches area opening into the degreasing chamber, where the skins are suspended as before described. The vapor taken up by the air is drawn by the fan through the condenser, and is there recovered; the air is then forced through the heater, and is raised to a suitable temperature which will not injure the skins. These are placed at equal and known distances apart, so that the air passes through them, partly from the top of the goods, but principally by a space formed at the end of the chamber by a perforated baffler screen, through which the air is distributed into the tank, where it readily absorbs the moisture from the skins, and is then drawn through the condenser; the solvent is recovered, and returns by a pipe into the store tank.

It is evident that the air used for drying the goods, since it does not pass through the evaporator as in previous machines, is not contaminated with the vapor generated therein; therefore its absorbing capacity is much greater. The temperature of the air is readily seen by a thermometer attached to the top of the heater. The steam is regulated by an automatic arrangement for controlling the temperature of the air, so as to avoid damaging the goods by overheating. The three condensers are supplied with cooling water by a double-acting horizontal geared pump having a cylinder 10 in. by 18 in., delivering approximately 16,000 gallons per hour.

If our readers have followed this description, which is very easy to do by aid of the illustrations, they will perceive that the object aimed at by the inventor has been twofold; first, to insure that every square inch of each individual skin shall be uniformly acted on by the solvent, and that there shall be no spots or streaks in which grease shall remain to resist the entrance of the dye. Second, to conduct the drying of the skins under conditions that will do them no injury, and will at the same time save the benzine from wasting. Both these points are of great importance, for the value of the finished goods depends alike on the thoroughness of the treatment and upon their being delivered in the best possible condition. The apparatus has been carefully designed for its purpose, and bears the promise of success.

We are indebted to London Engineering for the cuts and description.

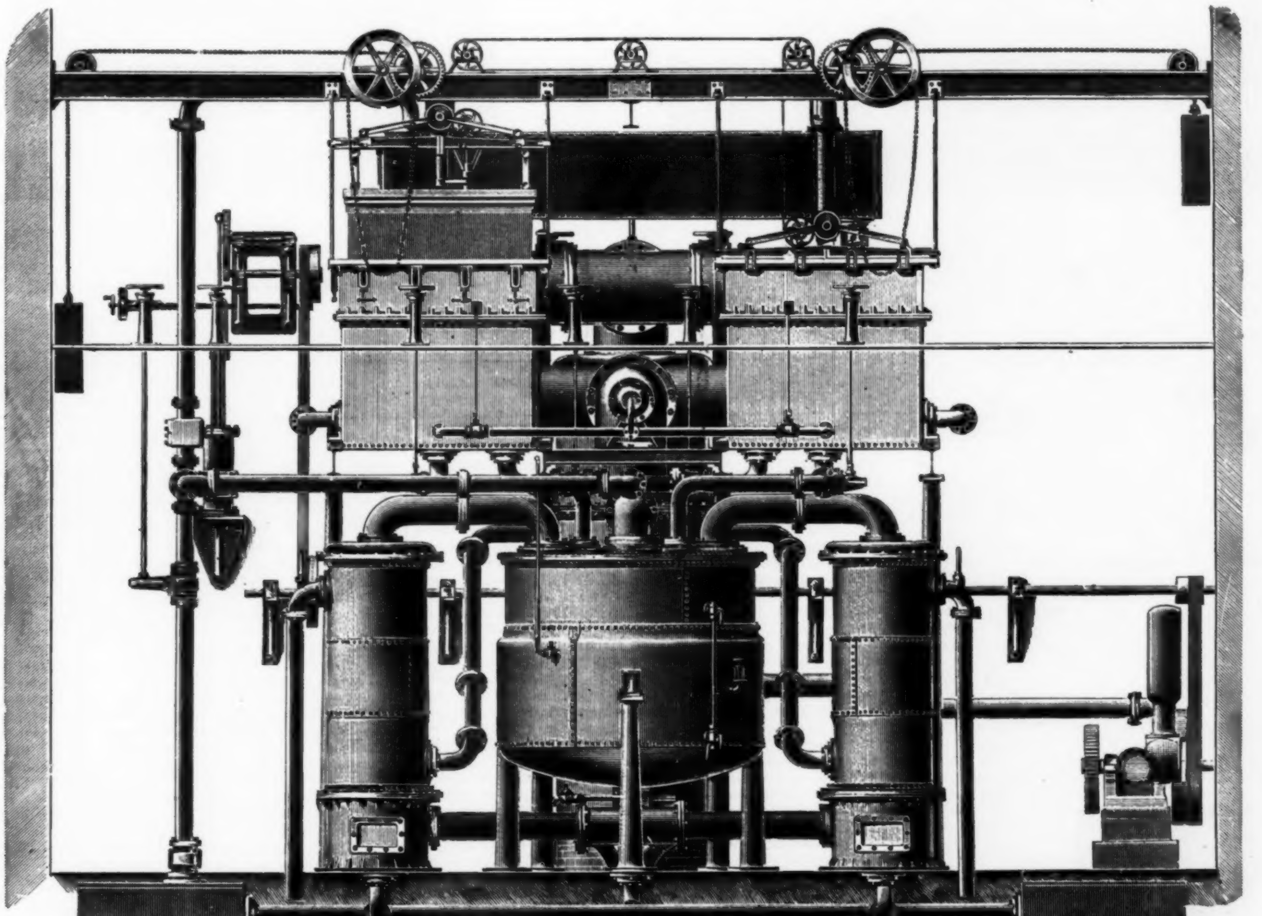


FIG. 2.—MACHINERY FOR DEGREASING LEATHER.

SOME EXPERIMENTS WITH KATHODE RAYS.*

THE extensive employment of the focus form of Crookes tubes as the most efficient known means of generating X rays has rendered advisable the more complete investigation of the kathode ray discharge in tubes of this description.

Hitherto, the usual method of investigating the characteristics of a kathode ray discharge apart from its mechanical properties, and beyond what is visible to the unassisted eye, has been by allowing the rays to fall upon a screen of some brightly fluorescent material, such as glasses of various descriptions, or screens covered with fluorescent salts. With all of these the maximum amount of fluorescence appears to be produced by such comparatively weak kathode rays that in some cases the special effects produced by the more powerful rays seem to be more or less entirely masked, while the well known phenomenon of the fatigue of fluorescent substances, when exposed to the more active rays, conduces to the same result.

SURFACE LUMINESCENCE OF CARBON WHEN EXPOSED TO KATHODE RAYS.

I have found in some cases that by replacing the usual screen, made of or covered with fluorescent material, by one of ordinary electric light carbon, much appears which was previously invisible. When a concentrated stream of powerful kathode rays are focused upon a surface of carbon in this manner, a very brilliant and distinctly defined luminescent spot appears on the surface of the carbon at the point of impact of the rays, the remainder of the carbon remaining black. This luminescent spot seems to have a very close relation to the fluorescent spots on glass and on other fluorescent materials under similar influence. The effect is evidently a purely surface effect, as when the kathode stream is rapidly deflected by means of a magnet, the luminescent spot on the carbon moves with no perceptible lag. Further, though, as is also the case with glass, the whole of the carbon becomes gradually heated to a considerable extent if much power be employed for a long period of time, these luminescent spots are instantaneously produced on carbon of very considerable brilliancy with but a comparatively low power. Again, just as glass is known to become fatigued under the influence of kathode rays, so that after a time it refuses to fluoresce so brightly as before, so carbon is similarly fatigued, though only after having been very strongly acted upon. Carbon, like glass, also recovers its property of giving a surface luminescence to some extent, though it does not seem to entirely recover, at any rate, at all rapidly.

APPARENT FORM OF THE KATHODE RAY DISCHARGE IN A FOCUS TUBE.

As is well known, in tubes of the ordinary focus type with a single spherical concave kathode, the rays coming off normally to the kathode surface appear to converge in more or less of a cone to a focus, and if the vacuum be not too high, to diverge again immediately in another cone upon the other side of the focus. At higher vacua the rays, after passing the focus, do not appear to diverge again at once, but seem to form themselves into a description of thread which connects the convergent and divergent cones, and is longer or shorter according as the vacuum is higher or lower. The focus, or perhaps more correctly, the point at which this thread commences, seems always to be more distant from the kathode than the center of curvature of the latter, but the variation in this respect seems to be less and less the higher the exhaustion. This is no doubt due to the mutual repulsion of the rays, and accords with the assumption that the rays consist of charged particles, which travel more and more rapidly the higher the exhaustion. Probably for the same reason, kathodes that are only slightly concave focus further in proportion beyond their centers of curvature than do deeply concave kathodes, for the same vacuum.

APPARENT HOLLOWNESS OF THE DIVERGENT AND CONVERGENT CONES OF RAYS.

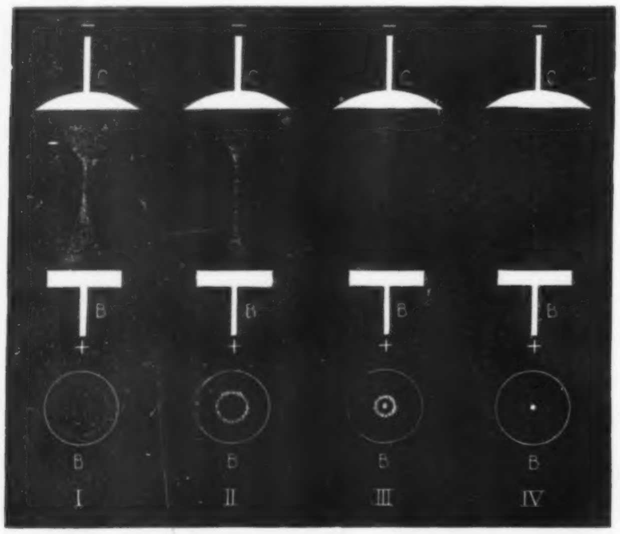
When the divergent cone is thrown upon a thin platinum disk, as in the ordinary focus tube, and sufficient electric power—say, from a 10 in. Ruhmkorff coil—is employed, the platinum quickly attains a red heat. With platinum, either the whole disk becomes uniformly heated, or, in the event of the diameter of the cone of rays where it strikes the platinum being small compared with the area of the platinum, that portion of the platinum covered by the base of the cone becomes uniformly heated to a higher temperature than the remainder. This is as much as can usually be seen with platinum, though rather more is sometimes visible with aluminum; but if, instead of either metal, the disk is made of ordinary electric light carbon, I have found that the luminescent portion of the carbon, instead of comprising the whole disk, or consisting of a uniformly heated circle, will in some cases take the shape of a brilliantly luminescent and apparently white hot ring, with a well defined dark and seemingly quite cold interior. As the dimensions of the cone of rays are increased or decreased by decreasing or increasing the vacuum, the luminescent ring will be found to increase or decrease correspondingly in diameter, at the same time being brighter when small than when large. Further, when the ring is very small it will usually have a very brightly luminescent central spot, with a dark intervening portion between this spot and the ring, and when the vacuum is further increased the ring will gradually close in upon the spot until only the latter remains.

Figs. 1, 2, 3, and 4 show diagrammatically these hollow effects for four different degrees of vacuum, 1 being the lowest and 4 the highest exhaustion. The upper portion of each of these figures represents the general appearance of the kathode discharge between the spherical concave aluminum kathode C at the top and the carbon anti-kathode B at the bottom. Beneath

* Abstract of a paper by A. A. C. Swinton, read before the Royal Society, March 11, and published in Nature.

each of the elevational views of the kathode discharge will be found a plan view of the carbon anti-kathode, showing for each condition of vacuum the effect of the kathode discharge upon the carbon anti-kathode, in forming a brightly luminescent hollow ring, gradually decreasing in diameter as the vacuum is increased, until it centers on a point, as already mentioned.

It may further be remarked that the diameter of the luminescent ring may be increased or diminished, or finally reduced to a point, without altering the degree of vacuum, by moving the anti-kathode away from or toward or finally into the focus of the kathode stream,



FIGS. 1-4.

the appearance of the ring in each of these cases being practically similar to those shown in the figures for a uniform distance with varying vacuum. Similarly it may be shown that the converging cone of rays between the kathode and the focus produce hollow rings upon a carbon anti-kathode exactly as does the diverging cone of rays. When the anti-kathode surface is not at right angles to the line of discharge, the ring, in place of being circular, takes the proper form of a conic section. The holding of a magnet near the tube distorts the ring from a circular shape and moves its position on the carbon.

From these experiments it appears that both the diverging and converging cones of kathode rays act as though they were not of uniform density throughout their sections, but, at any rate, in some instances as if they were completely hollow.

It should, however, be noted that these hollow effects appear only to be obtained with fairly short focus kathodes, such as are usually employed in X ray focus tubes, that is to say, with kathodes whose diameter is large as compared with their radius of curvature, so that the rays converge and diverge rapidly to and from the focus. With comparatively flat, long focus kathodes the cones do not show any signs of being hollow and produce a uniformly luminescent spot upon the carbon of larger or smaller diameter, according to the conditions of vacuum and the position of the screen.

For instance, while kathodes 1·125 inches diameter and 0·708 inch radius of curvature gave in the manner described distinctly hollow convergent and divergent cones, a kathode 1 inch diameter and 1·5 inches radius


FIG. 5.

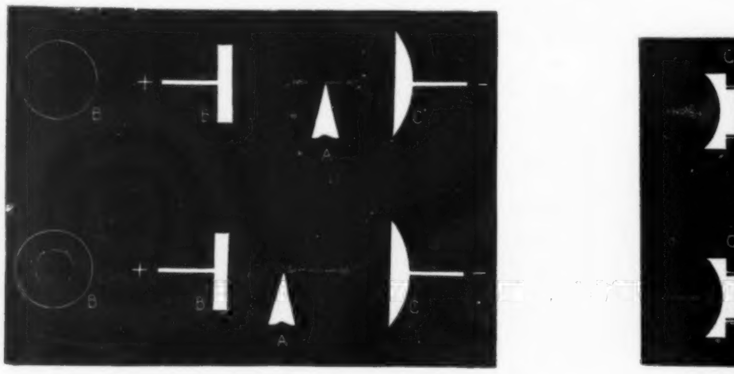
of curvature gave convergent and divergent cones that appeared to be uniformly solid under all conditions.

On the other hand, with rays from flat kathodes brought to a focus by magnetic means, both convergent and divergent cones are found to produce hollow ring effects.

THE RAYS CROSS AT THE FOCUS WITH NO ROTATION.

In order to investigate the kathode rays in a focus tube still further, and more especially in order to discover whether the various rays from the kathode cross one another at the focus, or diverge again without crossing, and also in order to discover whether there is any twist or rotation of the rays, similar to what has been observed in the case of rays focused by magnetism, a tube was constructed smiliar to that used in the previous experiments, with a carbon anti-kathode which was also the anode, fixed at the opposite side of the focus from the kathode, with the focus about equally distant between it and the kathode. The peculiarity of this tube consisted in the fact that a sector of the aluminum kathode, equal to one-eighth of the total area of the kathode, had been entirely removed, as shown at C, Fig. 5. It was expected that on using this tube, with the proper degree of vacuum to form a well defined ring on the anti-kathode screen, a portion of the ring, corresponding with the amount of the kathode cut away, would be found wanting; and that by the position of this gap in the ring it would be possible to ascertain whether the rays crossed at the focus and whether there was any rotation. What actually was observed is shown for three different conditions of vacuum in Fig. 5, B being for the highest and B'' for the lowest vacuum. As will be seen, the expected gap in the ring was obtained, but with the unexpected addition that the dimension of this gap, instead of being only one-eighth of the circumference of the ring, was seven-eighths of the circumference. In fact, the amount of ring shown corresponded, not with the seven-eighths of the remaining kathode surface, but with the one-eighth of the kathode that had been removed. The portion of ring that did appear was of a length corresponding exactly to the arc of the removed sector of the kathode, according to its greater or lesser nearness to the center with different conditions of vacuum; and as the portion of ring was in each case exactly in line with the portion of kathode that had been cut away, it would appear that there is no rotation of the kathode beam as a whole, that the rays do cross at the focus; and, further, that when the hollow convergent cone is, as it were, split in this manner, some unexplained action, similar in effect to the existence of a circular surface tension, causes the gap to widen out and the remaining portion of the ring-shaped section of the cone to contract correspondingly, without, however, altering its diameter.

In order to further investigate the matter another tube was made, in which the concave kathode was complete; but the interior of the tube was furnished with a small movable piece of aluminum, which by shaking could be moved up and down the tube between the kathode and anti-kathode, and which, while not quite reaching the center of the tube, would fill up very

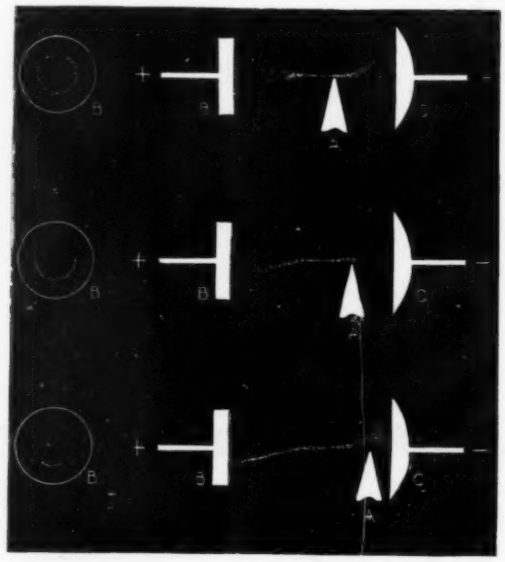

FIGS. 6, 7.

nearly one-quarter of the circular sectional area of the latter.

With this arrangement of tube, with the aluminum obstacle placed just at the focus, as shown in Fig. 6, the point of the obstacle just missing the kathode rays, a complete ring was formed on the carbon and anti-kathode. On moving the obstacle slightly into the divergent cone, exactly one-quarter of the ring on the anti-kathode failed to appear, as shown in Fig. 7, and on the obstacle being further moved in the same direction, the result was not altered.

As in each of the latter two cases there was no displacement of the gap in the ring, the above showed that there is no rotation of the divergent kathode cone.

Experiments were next tried with the aluminum obstacle, moved so that its point just entered the converging cone of kathode rays, when a small portion of the ring was cut out; but on the opposite side, as shown in Fig. 8, this confirming the previous experiments, which showed that the rays cross one another's paths at the focus without rotation. Upon moving the aluminum obstacle a little nearer to the kathode, so that its point entered still further into the convergent kathode beam, one-half of the ring disappeared, as in Fig. 9, while when the obstacle—which, it should be remembered, blocked only one-quarter of the circular


FIGS. 8-10.

area of the tube—was brought close up to the kathode, only about one-quarter of the ring remained, as in Fig. 10.

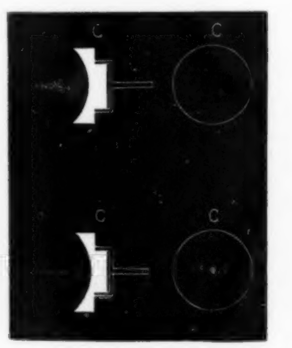
Further experiments were tried with the aluminum obstacle both in the divergent and convergent cones, but with the tube exhausted to different degrees of vacuum, when it was observed that when the obstacle was in the divergent cone, a portion of the ring was cut off exactly proportional to the angle subtended by the sides of the obstacle; while when the obstacle was placed in the convergent cone, a much larger proportion of the ring was cut off in each case, this being much more marked with a high vacuum, when the diameter of the ring was small, than with a low vacuum, when the diameter of the ring was large.

THE CONVERGENT CONE AT HIGHER VACUA.

The carbon anti-kathode screen was found useless for investigating the convergent cone of kathode rays at anything but a very low vacuum, by the reason of the well-known difficulty in getting any discharge to pass when the distance between the electrodes is less than the thickness of the dark space; and for the further reason that if the anti-kathode screen was not connected to the anode, it became itself negatively charged, and acted as an additional kathode when brought into the space between the kathode and the focus.

Under these circumstances, it was thought that possibly some additional information might be obtained with regard to the form of the convergent cone at high vacua, by making the concave kathode itself of carbon.

A tube was therefore constructed having a concave carbon kathode, the diameter of which was 1 inch, and the radius of curvature 0·75 inch. The appearance of the kathode with this tube is shown for a fairly high vacuum in Fig. 11, in which the kathode itself is shown

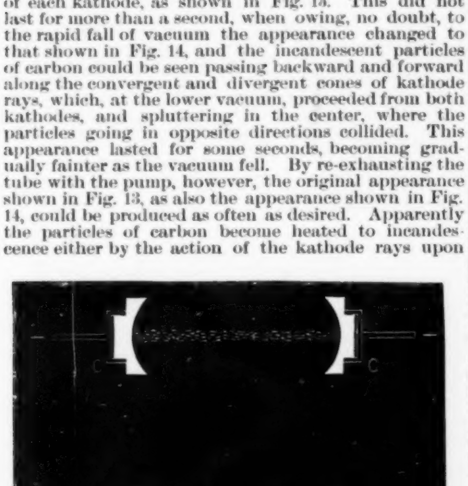

FIGS. 11, 12.

in section, so as to let the form of the discharge be better seen. As will be observed under this condition of vacuum, which was too high to show any divergent cone, the cone of convergent rays appears to be contracted in diameter at its base, and to come off from the central portion of the kathode only, the remaining surface of the kathode being apparently inactive. This was found to be still more the case at higher vacua, as will be seen from Fig. 12, which shows in a similar manner the form of the kathode discharge in a tube exhausted to a very high vacuum. In this case, as will be observed, the whole of the kathode rays appear to come off from a very small spot in the center of the kathode. Further, that this small spot is, at any rate,

the source of most, if not all, activity, was evident from the fact that it became luminescent exactly in the same manner, but in a less degree, that had previously been observed with a carbon surface upon which kathode rays were concentrated. Whether this surface luminescence of the kathode carbon, at the point where the kathode rays leave it, is due to the violent tearing away of particles of carbon, or to some other cause, it is difficult to say; but the fact that at high vacua the kathode rays come entirely—or, at any rate, almost entirely—from only a very small portion of the center of the kathode, explains the observed fact that within limits, large kathodes have no advantage over small kathodes in X ray tubes.

During the carrying out of the above experiments with a carbon kathode, very bright sparks were occasionally seen coming off the kathode and passing through the focus, and it was consequently thought that possibly by placing two concave carbon kathodes facing one another, such particles, by being caused to rebound backward and forward continuously between the two, might render the form of kathode stream visible at very high vacua when the stream itself becomes otherwise invisible.

With this view, a tube was made with two concave carbon kathodes, similar to those employed in the last experiment, were placed exactly opposite one another. The anode was placed in an annex, and the two kathodes were connected together by means of a wire outside the tube. At a very high exhaustion, this tube gave very beautiful effects, and showed clearly the form of the kathode discharge at a degree of exhaustion when it is usually in itself quite invisible. Immediately on the current being turned on and the discharge passing, a straight and thin stream of bright golden colored particles of apparently incandescent carbon passed between small luminescent spots at the centers of each kathode, as shown in Fig. 13. This did not last for more than a second, when owing, no doubt, to the rapid fall of vacuum the appearance changed to that shown in Fig. 14, and the incandescent particles of carbon could be seen passing backward and forward along the convergent and divergent cones of kathode rays, which, at the lower vacuum, proceeded from both kathodes, and spluttering in the center, where the particles going in opposite directions collided. This appearance lasted for some seconds, becoming gradually fainter as the vacuum fell. By re-exhausting the tube with the pump, however, the original appearance shown in Fig. 13, as also the appearance shown in Fig. 14, could be produced as often as desired. Apparently the particles of carbon become heated to incandescence either by the action of the kathode rays upon



FIGS. 13, 14.

them while they are flying through space, or by their friction in passing through the residual gas, and possibly by their mutal collisions, for in the stage shown in Fig. 14, when the kathodes themselves show no luminescence the flying particles appear to be most intensely luminescent when in the center of the tube. It may be mentioned that after this experiment had been repeated several times, the glass of the tube became perceptibly blackened, which, taken with the fact that a similar tube with kathodes of aluminum showed no stream of bright particles, goes to show that the particles consist of carbon torn off the surfaces of the kathodes.

THE PRODUCTION OF X RAYS.

In order to ascertain whether it is necessary that the kathode rays should fall on solid matter in order to produce X rays, another tube was constructed, similar in all respects to the last, with the exception that the two kathodes were made of aluminum.

It was thought that with this tube the opposing streams of kathode rays might possibly produce X rays at the point where they met. This does not, however, appear to be the case, as though this tube, when exhausted to so high an extent that the alternative spark in air leapt fully eight inches, gave X rays in considerable quantity, these rays appear to come entirely from portions of the glass of the tube that were covered with green fluorescence, and not at any rate appreciably from the central point between the two kathodes where the opposing streams of kathode rays would meet one another.

It seems, therefore, that X rays can only be produced by kathode rays when these strike solid matter.

No doubt this matter must also be positively electrified.

YOGI MAGIC IN INDIA.*

I HAD heard vaguely long before I reached India that there was a band of the Yogi—the so-called sanctified Yogi—somewhere up in the northern part of the country—a sect, in fact, who not for a mere living, but apparently from religious conviction, performed miracles. And so—though I was told it would take me at least a week to accomplish my purpose—I started one night from Delhi northward for the unknown. It was a very long journey, but one that is undertaken every year by the more wealthy people—the English particularly, who during the winter manage to survive this cloying, deadening climate. On this slow railway it took one day to reach Simla, and from there the voyage was more or less precarious. Trains were few and connections very infrequent. The population grew less dense, the people more hardy. We gradually got into a hilly country where barbarism still survived; that is to say, the severe impact of European civilization which distinguished the lower part of the country seemed to fade away, and we got into the native, genuine and historic Indiaism. English officials were fewer, and one saw only an occasional trooper. Now and then soldiers invaded the third class section of the train, but they were all natives, excepting an occasional English officer. And, without dilating on the tediousness and the annoyances of a very long trip, I got at last to the foothills of the Himalayas, a little village with an unpronounceable name, from which we took horses for thirty miles further into the interior, and then, as the route grew more precipitous, mules. An occasional inn was found, but the country had almost completely lost its English character. We traveled on higher and higher. I had the map well routed for me, and I was told I could make no mistake as to my destination. Toward sunset of the second day my courier pointed out to me in the towering distance a small congregation of huts surrounding a principal edifice of stone. "There," said he, "is the abode of the Yogi."

I had been careful to provide myself with first-class recommendations, and so I feared no refusal on their part to allow me to enter the sacred precinct. Making our way through a tortuous defile down the mountain side, we passed a sparse population, finally to reach the gate of what looked not unlike a monastery of the mediæval times. Absolute silence reigned there, and I was puzzled how to enter. There was no bell, no knocker; only a huge wooden gate made of unhewn logs, but a very respectable barrier in itself. My interpreter informed me that the doorman only came every half hour, and that I should have to wait until he made his rounds. So allowing the mules to graze at leisure, I sat with my companion upon a bench that stood beside the place, and patiently waited permission to enter. Ten minutes passed, and then I saw emerging from the distance in the gloom a tall, gaunt, specterlike person clad in a gray robe. As he approached I noticed that he was wondrously thin; cheeks sunken in, deep set eyes, and altogether the mien of a Franciscan of old. In fact, the whole atmosphere was monkish. It recalled to me the stories I had often read of the monasteries of the mediæval days. It seemed as if I had gone back four or five centuries of civilization. There was no greeting in his demeanor. My interpreter handed him my letters, and he shuffled off, to disappear as mysteriously as he came. Another fifteen minutes' wait. Then he returned and laboriously opened the gate. Not a word passed his lips, either to myself or to my companion. He signed us to follow him, which, of course, we did.

We found ourselves after traversing a parallelogram some seven or eight feet long silently shown into what seemed a small ante-chamber. There, very shortly after, came to us a man quite the reverse of the one we had seen—an athlete in appearance, strong as to sinews, heavy in build, neither fat nor lean, and possessing a countenance that one would say at the jump was one of great intelligence. He was kindly in his greeting, neither shaking hands, however, nor bowing. And I took my demeanor from his. He asked us why we came there, and I replied that I wished to witness the mysteries of the Yogi. He told me that, unfortunately, this was the time of year when they were in retreat. He explained, as well as he could, that they were an ascetic order, not given to the display of their powers to strangers. I made bold to ask the purpose of the sect, and he explained that they were ascetics; that they believed in the exercise of religion through the visual sense; that is to say, the powers of a perfect man could be so developed as to appear miraculous to the imperfect. And what wonders they accomplished were through the direct interposition of Buddha with God. This conversation may have lasted some twenty minutes, and it took place standing. This man, who, it seems, was the superior of the order, asked us to partake of the repast then due. We accepted willingly, and entered a large refectory, perhaps seventy feet long by about twenty broad, bare of everything excepting one long table, benches, and two or three smaller tables at the end. To one of these we were assigned, while the superior took his position alone. Then the members of the order filed in in silence. The repast consisted of milk curds, honey, and a species of unleavened bread heavy as dough. We were treated to small portions of kid, but I remarked that nobody else in the place ate any; in fact, they were not served with it. Most of them looked like the man who originally let us into the gate; occasionally there were two or three words of conversation that appeared to be necessary, but no general talk. And during the entire repast I never saw one smile permeate the countenance of any there.

In my search for information I feel bound to say that I met with disappointment. The superior took me out into the yard surrounded by the parallelogram, showed me a recent grave and said, "One of our brethren sleeps there." As there were marks of graves all around the place, it struck me as of no particular significance, and observing my look of astonishment he spoke to the interpreter, who translated his meaning thus: "This man made an infraction of one of our rules. He had been condemned to forty days' solitary confinement. He is confined here. He will live." In short, I was told and asked to believe that a human being lay three feet under this earth, and would be resurrected at the end of his imprisonment and remain as whole as before. Ten days of his time were up. I confess that the temptation came over me for a moment to remain thirty days here and witness the resurrection, but the necessity of returning to the state forbade. I was assured by the people on the outside of the village that they had seen the burial of the man, though he was alive; that he submitted to his fate without a murmur, and that, at the time of his disinterment, all those who cared would be invited to witness the fact that he came to life again. After a while we went into a small darkened room; that is to say, two lamps stood behind us, and two others far in front. The superior asked me if I desired an example of their powers. I told him that that was the principal reason of my coming there. "Then, see this!" said he. One of the monks rushed forward and coiled a section of slight rope, threw it into the air and then scrambled up it. I saw as plainly as my eyes can see the rope thrown up and the man disappear hand over hand beyond my line of vision. But I have not the slightest doubt that it was an optical illusion. There was darkness all around. Nothing could have been easier than for the trickster to throw the rope, disappear in the black shadow, and a dummy be pulled up. At any rate, that is the way I explained one of the most mysterious and celebrated tricks of these Yogi. There is no doubt in my mind that these men, while perfectly sincere in their religious belief, employ tricks to affect the mind of the ignorant and give them the name of miracles. The bare truth seldom obtains. It must be accompanied by some supernatural manifestation.

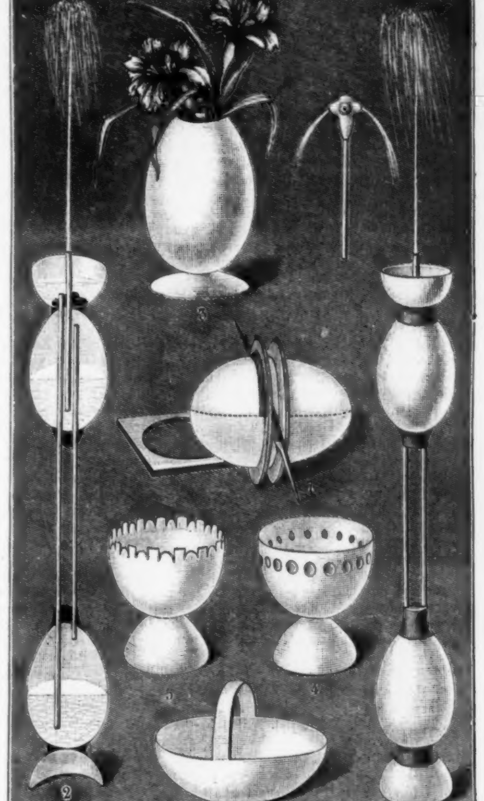
* Frederick Bancroft, in the Detroit Free Press.

OBJECTS MADE OF EGGSHELLS.

EGGS, which are prepared in so many different ways in the modern kitchen, may, in the hands of a friend of the sciences, become the object of a large number of amusing chemical and physical experiments.

The readiness with which the carbonate of lime of the shell is attacked by weak acids (by vinegar, for example) is taken advantage of in the curious experiment of a fresh egg passing through a ring, or in the artistic engraving of eggs, which are thus made to exhibit any sort of ornament in relief.

In the domain of physics, the experiments that may be performed with eggs, either full or empty, are extremely numerous. We may confine ourselves to a mention of the following: Making an egg stand erect upon the edge of a tumbler; the disobedient egg



OBJECTS MADE OF EGGSHELLS.

1 and 2. Heron's Fountain. 3. Bouquet Holder. 4 and 5. Cups. 6. Basket. 7. Method of Cutting an Eggshell with a File.

(center of gravity); the steamboat and steam balloons (reaction of gases); the waltzing egg and the egg peg top (centrifugal force); the egg areometer and the maximum density of water (density of liquids); the egg in the water bottle (atmospheric pressure); the Tantalus' cup (hydrostatic pressure); the egg mirror (refraction); and many others that we cannot enumerate here, and that would almost permit of modifying a celebrated saying in this way: Omne experimentum ex ovo.

Of the unpublished models that we present herewith, none has anything to do with the physical sciences, except the Heron's fountain. They are designed to prove that, despite their fragility, which is greater than that of glass, eggshells readily lend themselves to the manufacture of small objects of various kinds, either useful or ornamental, such as bouquet holders, baskets, match boxes, etc.

Mr. Martial Jacob, who made the objects here figured, according to our directions, conceived the idea of strengthening the shells at the place where they are to be worked with a tool by means of oval or circular templets cut out of metal, wood, or thick cardboard. If, for example, we wish to cut the egg at right angles with its axis, we form in a piece of cardboard a circular aperture of a diameter corresponding to that of the egg at the height that it is desired to divide it. We fix our cardboard ring to the eggshell by means of sealing wax placed upon the side of the shell that is to be removed. Then, by means of a very simple tool (a small file such as is used by watch makers) we file the circumference of the shell in placing the tool flat upon the face of the templet. The section having been made,

we polish the edge by means of very fine sandpaper or emery paper. It is by such very simple means as this that all the models shown in our engraving were made. For sections parallel with the long axis, the aperture in the templet should have an oval form. It is rectified by experiment in applying it to the shell.

Fig. 7 of our engraving shows how a basket shape may be obtained. Two rings serve to guide the file for the two edges of the handle. Of course, the cutting is done only as far as to the handle, that is to say, only according to half of the circumference. In the edge of the basket, after the two templets have been removed, the oval templet is fastened with wax parallel with the long axis of the egg, and the shell is filed until the handle is reached. In articles such as cups provided with a foot, the latter consists simply of a piece cut out of the large or small end of another shell. Care must be taken to form in the top of this piece a small aperture to permit of affixing it to the body of the cup with wax, and in such a manner that the latter shall be invisible.

If it is desired to form notches or apertures, like those shown in Nos. 4 and 5, the shell is filled with plaster gaged very stiff. After this has set, the shell may be worked with a file, saw or drill, as if it were a piece of stone. The plaster may be easily removed, since the internal membrane of the egg prevents it from coming into contact with the shell.

In the Heron's fountain (Nos. 1 and 2) the points of junction are reinforced with small pieces of cork and the joints are rendered tight by means of sealing wax. The tubes are of straw, as is also the nozzle, which is closed with wax through which a hot needle is passed so as to form a capillary aperture. Thus constructed, our fountain gives a jet over three inches in height. The vertical nozzle may be replaced by a small cork provided with three horizontal apertures and giving jets of a very pretty effect, especially when the fountain is surrounded with flowers.—A. Good, in La Nature.

THE VINEYARDS OF FRANCE.

The United States import in a year wine of the value of $7,000,000, and more than half of the wine imported comes from the republic of France. From Germany there is imported in a year to the United States wine of the value of about $250,000; but France overtops all countries in regard to this product, supplying the American market with between $4,000,000 and $5,000,000 worth of wine in each year. The official figures for the year 1896, taken from Le Moniteur Vinicole, the standard European authority, give these results in the chief wine producing countries, in hectoliters (a hectoliter is twenty-six gallons): France, 44,600,000; Italy, 21,570,000; Spain, 17,000,000; Austria-Hungary, 4,000,000; Roumania, 5,500,000; Algeria, 4,000,000; Portugal, 3,200,000; Germany, 3,100,000; Turkey and Cyprus, 3,000,000; and Greece, 1,300,000.

Notwithstanding the destruction incident to the Franco-Prussian war, the devastation done by the phylloxera and the increasing competition in the field of wine production from neighboring countries, where land and labor are cheaper than in France, particularly in Italy and Hungary, such is the productiveness of French vineyards, such is the excellence of the method of cultivation, and such is the attention given to the manufacture of wine, that France not only stands at the head of other countries in this particular, but also, as the late figures of 1896 show, the product of France, which was 26,000,000 hectoliters in 1895, against 24,000,000 in Italy and 20,000,000 in Spain, is this year larger than that of both these countries. During the past three years there has been an abnormally large wine product in France, but prior to 1893 the annual average of wine product was largest in Italy. There are eighty-seven departments of France, and in seventy-six of them there are vineyards. The proportion of red to white wine produced is as three to one, the price of red wine being slightly higher than that of white wine. Prior to the Franco-Prussian war the wine product of France (territorially larger than it is to-day) averaged 50,000,000 hectoliters in a year, and though these figures have not been duplicated since, the wine product of the country is as large in proportion to the territory included in it as it was twenty-five years ago, and the fact is to be recalled that while in other countries celebrated for their vineyards there has been decline in the product, and in some cases the important vinicultural interest has been destroyed, the vineyards of France yield grapes as plentifully as they have ever done.

In Madeira and the Canary Islands, once prolific in wine product, the present amount available for export is very small. Cyprus wine, too is no longer what it once was, and the wines of Greece, though abundant, are no longer held in great demand, and this to some extent also is true of some Spanish wines. The wines of Italy come chiefly from the neighborhood of Naples and from Sicily. Cape Colony, in Africa, has 20,000 acres of vineyards, producing 4,000,000 gallons in a year. Algeria has 140,000 acres, producing 4,000,000 hectoliters in a year. About one-quarter of the German wine crop comes from the former French department of Alsace. Down to 1889 there was a surplus of French wine for export, but from 1880 to 1893 the importations exceeded the exports. Now again the old conditions have been restored and France is exporting more than it imports, and while the amount available for export is increasing, as the late figures show, there has been a corresponding gain in the quality.

A new helmet has been served out, by way of experiment, to several regiments of the German army. It is very light, being made of aluminum, and is bronzed, in order to obviate the drawbacks which might arise from a bright metal head-dress. Germany has already tried aluminum horse-shoes, buckles, and accouterments, with a view to lightening the weight which the soldier must carry. For horse-shoes it has been found too soft, but in other respects it has answered well. There is one drawback which had not been foreseen, namely, that when exposed to the influence of the sun aluminum will store up heat to a remarkable degree, eventually becoming so hot as to blister the skin. Whether bronzing will obviate this defect remains to be seen, but the German experiment is one which is well worth the attention of all military men.—Army and Navy Gazette.

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